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May 24, 2004

VIA ELECTRONIC SUBMISSION

Ms. Marlene H. Dortch
Secretary
Office of the Secretary
Federal Communications Commission
445 12th Street SW
Room 5-A223
Washington DC 20554

      Re: *Review of the Commission's Rules Regarding the Pricing of Unbundled Network Elements and the Resale of Service by Incumbent Local Exchange Carriers,* **Docket No. 03-173**

Dear Ms. Dortch:

      As requested by Staff, please find enclosed a copy of the LECG Working Paper, "State Commissions Systematically Have Set UNE Prices Below their Actual Costs," which was referenced by Professors Aron and Rogerson in their December 16, 2003 paper, "The Economics of UNE Pricing," which was included with SBC's Comments.

      If you have any questions, please do not hesitate to contact me at (202) 326-8895.

                      Sincerely,

                      Jim Lamoureux
                      Senior Counsel
                      SBC Telecommunications, Inc.

Cc: Steve Morris
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State Commissions Systematically Have Set UNE Prices Below Their Actual Costs[+]

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The 1996 Telecommunications Act requires incumbent local exchange telephone companies to provide components of their networks to their competitors at prices "based on cost." The Federal Communications Commission devised a pricing methodology to be used by state regulatory commissions in their reviews of these prices. This paper demonstrates that most state commissions have misapplied the FCC's pricing method and that network component prices are often far below the costs that the incumbent companies actually incur to provide them. Underpricing of network elements is systematic and substantial, which indicates a flaw in the process used to determine these prices.

1. INTRODUCTION

The Telecommunications Act of 1996 ("TA96" or the "Act") sought to increase competition and reduce regulation in all sectors of the

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telecommunications industry.[1] The Act sets out requirements for local exchange carriers generally, and for incumbent local exchange carriers ("ILEC"), including the former Bell companies, specifically. Among the latter is the requirement that incumbents provide access to components of their networks— unbundled network elements ("UNEs")—to other carriers that want them. This requirement permits a new entrant to offer telecommunications services by using its own facilities in conjunction with (for example) the incumbent's loop (i.e., the line between the customer's premise and the incumbent's switching center). At present, competitive local exchange carriers ("CLECs") may even purchase the entire package of UNEs that the incumbent uses to provide telephone service as a "platform" (or "UNE-P"), eliminating any need for the CLEC to deploy network assets.[2]

Under the Act, prices for UNEs must be determined through negotiation between ILEC and CLEC, and either party may request mediation by the relevant state regulatory commission.[3] In determining price, these commissions must adhere to a pricing methodology or standard developed by the FCC. The current FCC standard requires that UNE prices be based on a methodology they call "total element long-run incremental cost" ("TELRIC"), which the FCC describes as the "forward-looking" incremental costs[4] incurred

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[1] The full title of the Telecommunications Act of 1996 is "An Act to promote competition and reduce regulation in order to secure lower prices and higher quality services for American telecommunications consumers and encourage the rapid deployment of new telecommunications technologies."

[2] Under the FCC's "UNE Remand Order," unbundled local switching (and hence UNE-P) need not be provided in the top 50 metropolitan statistical areas for end-users with four or more lines provided that the ILEC provides nondiscriminatory, cost-based access to combinations of loop and transport unbundled network elements. (FCC UNE Remand Order, ¶¶ 253, 274-78.) Subsequently, in its Triennial Review Order, the FCC concluded that (1) customers served at the DS-1 level and above (i.e., "enterprise" customers) presumptively are not impaired without access to unbundled local switching (FCC Triennial Review Order, ¶ 451); (2) but that this is a rebuttal presumption, that should be based on an investigation by state regulatory commissions (FCC Triennial Review Order, ¶ 455); and that (3) the states should also conduct an analysis to confirm (or refute) the use of four lines as an appropriate size cutoff for enterprise firms where it makes sense to be served with a DS-1 loop (FCC Triennial Review Order, ¶ 497).

[3] Telecommunications Act, §252(a)(2).

[4] "Incremental" costs of a network element i in this context are defined as the difference between total costs of providing the existing set of elements $\{N\}$ at current quantities; and the total cost of providing the existing set of elements other than i $\{N-i\}$ at current quantities. The FCC also requires that the cost analysis include a markup for "a reasonable share" of non-incremental ("shared" and "common") costs. Prices are determined by dividing the aggregate of incremental and marked-up costs by the number of units of the element.

by a "hypothetically efficient firm" that displaces the incumbent's network with a new network, built with today's most modern equipment, at contemporary (forward-looking) prices.[5]

The "forward-looking" costs of a "hypothetical" firm may differ from the costs actually incurred by the incumbent provider to provide the network elements in question. As we will discuss later, forward-looking costs may be lower than actual costs to the extent that actual costs reflect inefficiencies or reflect input prices, such as those of electronics, that have fallen over time. They may be higher to the extent that forward-looking costs reflect inputs such as labor whose prices generally have risen over time. We will also explain that simulation research indicates that in nine out of ten applications, forward-looking cost estimates are likely to be no more than 19 percent less than, or 4 percent more than, actual costs.

UNE prices set by state regulatory commissions are below the costs actually incurred by incumbent providers in 44 of the 48 states (and Washington D.C.) that we examine.[6] Moreover, the price-to-cost deficits in these 44 states are substantial in many instances. We find that, on average, UNE-P prices are about 64 percent of 2001 costs and that the average *deficit* between price and cost is about $10.46 per line per month. In only four states do UNE-P prices exceed UNE-P costs.[7]

Our thesis is that UNE prices deviate sufficiently from actual costs as to reject the notion that state regulatory commissions, as a whole, properly apply the FCC's TELRIC methodology. Quite simply, UNE prices do not cover the costs of real-world firms, nor do they cover the costs of a realistic, though hypothetical, firm that has the assumed ability to widely deploy new, commercially available technologies and techniques. Rather than implementing an efficient, pro-competitive pricing mechanism in an area where a functioning market has not yet developed, state commissions have misapplied the FCC's TELRIC-based methodology, possibly in misguided attempts to stimulate market entry.

Such courses of action are contrary to the goals of the Act as described in its title and preamble. The Act seeks more competition, less regulation, lower prices, higher service quality, and wide deployment of new technologies. Underpriced UNEs accomplish none of these goals over the long term.

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[5] The methodology assumes the existing location of the incumbent's switching centers, but provides flexibility in technologies, equipment, and processes in serving total demand from those switching centers. (FCC Local Competition Order, ¶ 636 (total demand) and ¶¶ 679-686 (methodology).)

[6] ILECs typically do not serve the entire geographic area of a state. We refer to ILEC-served portions of states (and jurisdictions such as Washington, D.C.) as "states" for convenience. We do not examine Alaska, Hawaii, or Connecticut for lack of UNE price data.

[7] The 2001 costs incurred in West Virginia, Montana, South Dakota, and Wisconsin were less than the UNE prices estimated to be in effect during November 2002.

Although underpriced UNEs can enhance the fortunes of individual competitors, such prices damage the incentives for investment and the process of competition. Moreover, by reducing investment incentives, underpriced UNEs prolong the need for regulation and retard technological innovation that would reduce costs, reduce efficient prices, and increase quality.

In the balance of this paper, we describe our cost analysis. We describe how and why our results can serve as a sanity check to UNE pricing that putatively is based on the TELRIC methodology, and explain the policy implications of our results. Ours is not the only study that evaluates current UNE prices relative to actual costs. We also review and address the white papers that we are aware of that purport to arrive at the opposite conclusion, namely that UNE prices are not systematically below cost, but instead provide adequate compensation to the providers. We demonstrate that these papers either fail to account for many costs or that they erroneously account for capital-related costs so as to substantially understate them.

2.   WHY BOOK COSTS MATTER

Our analysis is based on booked costs of incumbent carriers. A company's book of accounts provides a record of how the company has deployed with investor-supplied capital. These books typically reflect revenues, expenses, investments, and accounting profit (or net income) among other items. Though they may not (and likely do not) perfectly reflect economic costs, accounting data objectively describe, subject to specified rules, cost events that have occurred. The FCC's TELRIC-based methodology deviates from actual, booked costs in two respects. First, the FCC's TELRIC-based methodology is forward looking, which means that it considers the costs that would be incurred if the investments and expenditures were made today, rather than those that were incurred in the past. (FCC Local Competition Order, ¶ 620) Second, the FCC's TELRIC-based methodology is supposed to reflect the costs of a hypothetically efficient carrier in certain respects[8] rather than adhering mechanically to the costs of the incumbent's actual network.

Hence, the FCC's TELRIC approach requires that the carrier consider not just costs based on current rather than historical prices, but also the costs that would occur were the carrier to provide its services using a different technology mix than the one it actually uses. For example, the hypothetical approach might involve carrying more (or less) inventory of spare capacity than the carrier normally holds and it might involve the use of fiber optics in some cases where the actual network uses copper facilities. The hypothetical firm thus has some flexibility, relative to the existing ILEC, in widely deploying new technologies, but this flexibility is not infinite. The TELRIC approach requires that the hypothetical firm use facilities and technologies that are generally available in the market and it precludes the use of cost estimates that are associated with a

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[8]   In its *Verizon* opinion, the Supreme Court held that TELRIC may "calculate [] the forward-looking cost by reference to a hypothetical, most efficient element at existing wire centers, not the actual network element being provided." (*Verizon* 2002, p. *7)

technology that sits on the inventor's workbench but which is unavailable at commercial scale and quality, or, as noted by the Supreme Court, the cost of elements that the competitor alone has built.[9]

Although the FCC's TELRIC approach deviates in two important ways from actual costs, the deviations do not render irrelevant an investigation of actual costs or the benchmarking of putatively TELRIC-based prices. The reason is that actual booked costs and forward-looking costs are related.[10] As noted by Benjamin Graham, David L. Dodd, and Sidney Cottle in their classic book on security valuation, continuity between the past and the future is the reason that equity investors (who, in theory, are interested most in the firm's prospects) should be interested in a firm's past results. In a text that has guided several generations of investors and investment analysts, these authors explain:

> In the selection of common stocks much more emphasis is placed upon *future expectations* as the primary basis of attractiveness and value. In theory these expectations may be so different from past performance that the latter could be virtually irrelevant to the analysis. But this separation of the future from the past rarely occurs in practice. A tendency toward an underlying continuity in business affairs makes the financial record the logical point of departure for any future projection . . . . The investment approach to every kind of security—which is the analytical approach—requires the proper application of income-account and balance-sheet analysis. (Graham, Dodd and Cottle 1962, pp. 105-106)[11]

Actual costs and revenues generally are relevant to the firm's future prospects. Actual costs can provide useful information about future revenues and costs even though an investor (presumably) realizes—and is routinely warned—that the future may be different than the past. It should be obvious that investors would want to know what management is doing with the money that investors already have provided, and that this knowledge can provide important information regarding the expected productivity of the incremental investment dollar. In the context of unbundled network elements, whose prices are regulated by the state, there is a policy imperative to understand whether the regulated prices provide the opportunity for investors to earn a return commensurate with investments of similar risks because this affects the development of competition and the attractiveness of telecommunications

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[9]   The Supreme Court stated, "Owing to that condition of current availability, the marginal cost of a most-efficient element that an entrant alone has built and uses would not set a new pricing standard until it became available to competitors as an alternative to the incumbent's corresponding element." (Verizon 2002 p. 26)

[10]   An exception to this general rule can occur when a firm substantially restructures (e.g.) by selling or acquiring lines of business.

[11]   Emphasis in original.

infrastructure investment in the state. An evaluation of actual costs can assist regulators to attain that understanding.

It has been a matter of substantial controversy in state-level commission proceedings (though not, apparently, in the professional literature) whether commissions should consider analyses of actual booked costs to assess the validity of the TELRIC-based models that they are presented. Because TELRIC cost models typically hypothesize a reconstructed network that does not match any carrier's actual network, and then estimate the costs of that hypothesized network, there is little if any source of benchmarking (other than against other TELRIC models) that is available to a commission, if it does not benchmark against actual costs. Hence, if state commissions reject the use of actual costs as a validity check (as CLECs often urge them to do), they are left to adjudicate among disparate expert opinions as to the validity of various inputs and assumptions, but with no reality check on the reasonableness of the models' outputs.

In their book on this subject, economists Dale Lehman and Dennis Weisman make much the same point as do Graham, Dodd, and Cottle regarding the usefulness of historical accounting cost information, specifically as it regards ILEC costs. Lehman and Weisman argue that a telecommunications carrier's actual, book costs provide useful information about future costs because, over time, book costs respond to the same forces that drive forward-looking costs. They note:

> The commonly asserted irrelevance of embedded costs [to a TELRIC analysis] results from a fundamental misunderstanding of both methodologies. The difference between embedded and forward-looking TELRIC+ costs is not the difference between the past and the future. Embedded costs are not static—they change according to the same forces as those driving forward-looking costs. If investment costs are decreasing over time, both embedded and forward-looking TELRIC+ costs will exhibit decreases, with the latter manifesting some inertia not present in the former.[12] *Embedded and forward-looking TELRIC+ costs are both current views of costs.* The perspective differs, however, with one looking forward and the other looking backward. (Lehman and Weisman 2000, 66)[13]

Forward-looking costs of a hypothetically efficient firm may, in theory, be greater or less than booked costs of the incumbent. Although there appears to be a pervasive assumption in regulatory proceedings that TELRIC costs must be

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[12] As printed. The terms "former" and "latter" are inadvertently reversed.

[13] Emphasis added. "TELRIC+" refers to the FCC's pricing methodology for UNEs, which starts with the FCC's TELRIC cost methodology and permits the addition of a markup for shared and common costs, as described *supra*. *Id.* at 65.

less than actual costs, there are several reasons why the forward-looking cost of a hypothetical firm might exceed the book costs of the incumbent. First, the prices of many inputs, such as land and labor, have increased over time. Under the accounting principles used for industrial firms in the U.S., the costs of long-term assets are carried on a firm's books at the purchase price, which would include the associated capitalized labor from a period when it may have been less costly (Kieso 1989). As a result, book value can be less than forward-looking costs.[14] Second, to the extent that that competition shortens depreciation lives going forward, forward-looking depreciation costs would exceed book-value historical depreciation costs (*ceteris paribus*). And third, as a carrier loses market share to new competitors, and as its market share becomes more volatile than in the past, it would tend (for each reason separately) to efficiently hold more spare capacity in outside plant per customer than it did in the past. This also will contribute to higher TELRIC costs relative to actual, booked costs. Because the TELRIC approach presumes that the most efficient available technology is in use at all times, the model also deviates from the reality of overlapping vintages of technology. This implies that an internally consistent TELRIC model necessarily would assume a much higher rate of obsolescence than is likely to have actually been (or will be) experienced.

If the most efficient forward-looking technology is cheaper than the technology in place in the existing network—because technology has become less costly, or the prices of key inputs, such as electronics or optical fiber, have declined—then forward-looking prices will be lower than actual booked costs, all else equal, even if the ILEC's existing network is as efficient as possible given the available technology and input prices effective during the time period over which it was built. If, in contrast, the forward-looking technology is more costly than legacy technology—a possibility in light of the fact that newer technologies provide a far greater array of services than older technologies—this will drive measured forward-looking costs above actual booked costs.

As a result, there is no *a priori* reason that forward-looking costs of an efficient carrier necessarily must be lower (or higher) than the costs that are computed from the companies' actual accounting data. It is therefore incorrect to assume that any difference between TELRIC costs and booked costs necessarily must be the result of inefficiency. Certainly, such conclusions are contrary to the FCC's economic notion of its TELRIC pricing concept. Indeed, in its *Local Competition Order*, the FCC concluded that "[W]e reiterate that the prices for the interconnection and network elements critical to the development of a competitive local exchange should be based on the pro-competition, forward-looking, economic costs of those elements, which may be higher or lower than historical embedded costs." (*Local Competition Order*, ¶ 705) The Supreme Court likewise acknowledged this possibility.[15]

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[14] For example, in California, AT&T submitted testimony in which the authors estimated that one would have to adjust upward the existing base of SBC California's telephone loop plant on the order of 40 percent to reflect the "current" cost of that plant. (Brand 2002)

[15] In the text of its opinion, the Court speculated that differences between forward-looking costs and actual costs are due to inefficiency, but in the

In regulatory proceedings, the difference between purported TELRIC costs and actual costs, nevertheless, typically has been attributed, implicitly or explicitly, to "inefficiencies" of the incumbent carrier. Such a conclusion is difficult to reconcile with the contemporary method of retail regulation in local exchange telecommunications. Since the late 1980s, state regulatory commissions in the United States have replaced traditional rate of return regulation, which in essence is a "cost-plus" method of regulation, with "incentive regulation" that permits ILECs to retain profits created by eliminating inefficiencies. Incentive regulation harnesses the profit motive to improve ILEC efficiency and investment incentives.

Incentive regulation at the federal and state levels was partly motivated by the recognition that the traditional rate-base/rate of return methodology created incentives for inefficient deployment of resources. For example, economists have long understood that rate-of-return regulation impairs the incentives of regulated firms to minimize costs. Because cost increases (if approved by regulatory commissions) are passed through to consumers in the form of higher prices, management has a reduced incentive to restrict spending on items that make their jobs easier, more pleasant, or more secure (Crandall 1995, 100-101). Moreover, management has little incentive to take the risk to make investments that might reduce costs, because the benefits of such investments, if successful, would not be enjoyed in the form of higher earned returns.

Today, rate of return regulation is no longer the predominant form of retail rate regulation in the U.S. Indeed, for large ILECs such traditional regulation is used in only six states covering fewer than four percent of the nation's access lines.[16] Table 1, which is an update of research by Sappington (2002, p. 237), shows the decline of rate of return regulation and ascendancy of incentive regulation (specifically, price cap regulation) since 1989.

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footnote to the same sentence, the Court contradicts itself by concluding, "in theory, embedded cost could be lower than efficient cost." (*Verizon* 2002, *80, fn. 29.)

[16] By year-end 2002, traditional rate-base/rate of return regulation of the state's large ILEC remained in only New Hampshire, Alaska, Arizona, Hawaii, Montana, New Mexico, and Washington, which collectively account for about 3.8 percent of the nation's ILEC access lines. Price cap regulation is largely accepted by state regulatory commissions in the U.S. for those services that are still deemed in need of regulation. As of 2002, earnings-sharing was no longer present in any state. Some states are moving beyond retail rate regulation. (Communications Daily 2001)

Table 1: Method of State regulation of the Retail Prices of Large Local Exchange Services Carriers				
		Incentive-Based Regulation		
Year	**Rate of Return Regulation**	**Earnings Sharing Regulation**	**Price Cap Regulation**	**Other (e.g., Rate Case Moratoria)**
1989	29	8	0	13
1992	18	20	3	9
1995	18	17	9	6
1998	13	2	30	5
2000	7[*]	1	40	3
2002	6	0	43[†]	2

Notes:

[*] According to a 2000 report by Warren Publishing, Inc., the states of New Hampshire, Alaska, Arizona, Hawaii, Montana, New Mexico, and Washington had their largest incumbents under rate-of-return regulation as of October 2000. Small to mid-sized incumbents generally remained under rate of return regulation in most states, although many smaller incumbents had the option of alternative regulation plans. See "States Found to Use consistent Pattern in Regulating Local Rates," Communications Daily, November 1, 2000.

[†] In Massachusetts, the price cap plan for Verizon expired in August 2001. The Department of Telecommunications and Energy is currently considering a Verizon proposal for a new 5-year cap plan. Decisions on this plan are expected to be issued in the course of 2003. In West Virginia, Basic services are capped at their current levels, access charges are capped, and competitive categories are deregulated.

Sources: State Commission websites; Sappington (2002) ; and Communications Daily (2002)

Price cap regulation provides "high powered" incentives to seek cost minimization and efficient investment. Nevertheless, despite the fact that state regulatory commissions have widely adopted price cap regulation, there has been surprisingly little recognition by these commissions of the implications of that regulatory innovation for TELRIC pricing. Clearly, the more powerful the ILEC's incentives to operate efficiently, and the longer those incentives have been in place, the less difference there should be, all else equal, between actual costs and TELRIC costs particularly for carriers under incentive regulation. Accordingly, there is a relationship (albeit a possibly complex one) between a carrier's historical costs and its TELRIC costs. This relationship is particularly amenable to study in telecommunications, where both prices and technological change (productivity) have been subject to considerable analysis in the incentive regulation proceedings. State commissions and the industry have a record of input price changes that have occurred in the industry (for capital, labor, and materials) and of the ability of the industry's service providers to adapt to and use new technologies (i.e., increase productivity). This understanding, not to mention the quantified estimates of the pace of such changes, can serve as the bridge between actual costs and forward-looking costs. One can reasonably

conclude that putative "cost" estimates that are far removed from actual costs, and that cannot reasonably be explained by the technological progress of the sort that the industry has seen, are not truly TELRIC-based estimates, but instead represent wishful thinking.

State regulatory commissions that are charged with the duty of assessing forward-looking costs should, therefore, welcome the ability to test purported TELRIC models against the costs actually incurred by real-world firms. Indeed, according to Lehman and Weisman, such an assessment is essential:

> Actual embedded cost and forward-looking TELRIC+ cost studies will generally produce different results, but embedded costs can and should serve as a validation check on proposed TELRIC+ cost estimates. (Lehman and Weisman 2000, 65)

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> This exercise is essential, as current costs are the most consistent and verifiable cost measure available to regulators. Forward-looking TELRIC+ cost proxy models must of necessity make assumptions about the future. Yet, *if there is no systematic relationship between the estimated costs and the embedded costs the proxy methodologies become impossible to verify*. The assumptions and algorithms can be examined, but no empirical testing is possible. Expert opinion can be utilized, but forecasts of technology and business practices are notoriously unreliable.

> It is unwise to base regulatory practice on inherently unverifiable exercises. Incentives to report accurately would be severely lacking and the ability to misreport such forecasts is exacerbated by the likelihood that no empirical testing can be done of such forecasts. *It follows that embedded costs can and should be used to validate the reasonableness of cost proxy models*. (Lehman and Weisman 2000, 66)[17]

Understanding that actual, verifiable booked costs and forward-looking costs are related in known ways means that the former can serve as a benchmark to the latter. Lehman and Weisman call this benchmarking an "admissibility test." (Lehman and Weisman 2000, 77-79) Such a test can help the commissions determine whether costs derived from a putatively forward-looking model instead have entered the realm of rank speculation. (Lehman and Weisman 2000, 75-76)

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[17] Emphasis added.

The Supreme Court has reviewed and upheld the legal viability of the FCC's TELRIC methodology. It has been argued in regulatory proceedings that the Court's ruling precludes commissions from considering actual costs in assessing TELRIC models. Just the opposite is true, however, in our view. When the Supreme Court upheld the FCC's TELRIC-based methodology as consistent with the language of the Telecommunications Act, the Court did not require policy makers to ignore tests of the validity of the application of the methodology in any given case. In fact, the Supreme Court opined that the FCC's TELRIC-based pricing methodology must be understood to permit compensatory prices, through the proper selection of model inputs to reflect the idealized assumptions of the FCC's TELRIC model.[18] That is, the Court concluded that proper application of the FCC's TELRIC-based pricing methodology requires recognition of and the opportunity to recover their actual costs. The Supreme Court specifically rejected the ILEC's argument that TELRIC is, in principle, confiscatory. (Verizon 2002, *12-*16 and *99-*100) The Court rejected this argument *not* on the grounds that confiscation is irrelevant (which would tend to support the view that comparison to actual cost is likewise irrelevant), but rather on the grounds that confiscation must be demonstrated in a specific case, empirically, and not in principle, generally. (Verizon 2002 *99-*102) Since the determination of whether prices are in fact confiscatory in any given case requires comparison to actual costs, the Court's decision invites the sort of benchmarking that we perform in this paper.

3. AN EMPIRICAL ANALYSIS OF UNE PRICES AND UNE COSTS

3.1 Overview of the Approach

This paper provides estimates of actual, booked costs incurred by large ILECs for providing UNEs. In this section, we provide a general overview of our approach. In the following section, we discuss each of the main categories of cost that we examined, and then we discuss the prices to which we compare the costs. It is understood that the term "cost" includes not only out-of-pocket expenses, but also a return to investors that compensates them for the risk adjusted opportunity cost of capital. Accounting data provide operating expenses[19] and, through depreciation, a measure of capital repayment.[20]

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[18] In fact, the Court rejected incumbent carriers' argument that the FCC's TELRIC-based pricing model, even when properly applied, does not permit recovery of costs associated with increased risk and shortened asset lives. (*Verizon* 2002, *91) In addition, the Court recognized that rates may include "reasonable profit." (*Verizon* 2002, n. 19) (Hope 1944)

[19] In this study we use the term "operating expenses" to include cost of operations *excluding* depreciation expense, unless otherwise noted. We include in "operating expenses" selling, general and administrative costs, but we exclude interest expense (as well as income taxes and equity costs). Thus, revenues less "operating expenses" equals Earnings Before Interest, (income) Taxes, and Depreciation and Amortization ("EBITDA").

Accounting data also include interest expenses, which are a component of the cost of capital. However, accounting data do not normally provide for a return on equity capital, which represents the cost of investor money (cost of equity capital) used to fund capital investments. This study accounts for all of these items, including the income taxes on the equity portion of the return.

We derive total, actual costs associated with UNEs for each large ILEC for 47 states (and for Washington D.C.) from data obtained from the FCC's Automated Reporting and Management Information System ("ARMIS") for 2001.[21] These data are publicly available to investors and are the type of data used by investors to evaluate ILEC performance.[22] Large ILECs are required to submit certain data to the ARMIS system on an annual basis. The FCC has issued numerous rules, guidelines, and requirements that impart structure and comparability to the ARMIS data.

We develop costs associated with the unbundled loop ("UNE-L"), which a CLEC may use to obtain a physical transmission path (typically fiber optic cable and/or twisted copper wire pairs) between the customer's location and the CLEC's switch, and the unbundled network element "platform" ("UNE-P"), which a CLEC may use to provide all of the functions associated with local exchange telephone service to a customer. We obtain data primarily from the ARMIS 43-01 report.[23] For UNE-P we add to the UNE-L costs data from the

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[20] If the cost of the replacement capital is unchanged, revenues equal to depreciation expense ultimately will provide sufficient funds to replace exhausted capital.

[21] The 2002 ARMIS data do not yet include data for the 14 Qwest-served states. Our analysis therefore uses the last, full data set. We have also performed our cost analysis on the available 2002 ARMIS data and found the results to be consistent with those reported here.

[22] All ARMIS reports are publicly available online at www.fcc.gov.

[23] The 43-01is a high level, summary report that contains most of the LEC's accounting information at a fairly aggregate level. In a sense, the 43-01 is a top-down view of the 43-02, 03, and 04 reports. In turn, the 43-02 organizes data according to the so-called Uniform System of Accounts (USOA), or chart of accounts, as defined in 47 CFR 32 ("Part 32") of the FCC's rules. Part 32 provides account definitions and instructs complying carriers how to book any particular financial transaction. Part 32 is an application of "functional accounting." In essence, this means that the chart of accounts is intended to describe how the firm operates (i.e., how it functions), and it traces expenses and capital to the defined functions. The ARMIS 43-03 report contains cost breakdowns between regulated and unregulated activities as defined in the FCC's Cost Allocation Manual ("CAM") according to Part 64 of the FCC's rules. Subpart I (section 64.901 through 64.903) deals with how transactions between affiliated companies are to be treated and how costs of unregulated services are to be identified and accounted for. Finally, the ARMIS 43-04 report shows how costs are separated between the state and interstate jurisdiction in conformance to the Part 69 rules. Part 69 deals with access charges, and

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local switching and switched transport categories. These categories together account for most of the costs associated with UNE-L and UNE-P. Because our cost computations are based on the data reported in the ARMIS reports, such as the 43-01, we implicitly accept the FCC's "functions," its accounting rules, asset lives, and corresponding depreciation rates, for purposes of this analysis. We obtain data on revenues, expenses, capital (i.e., Telephone Plant in Service, or "TPIS"), and plant net of accumulated depreciation and other credits (Average Net Investment, or "ANI"). The 43-01 data that we use represent only the "interstate" portion of the ILECs' total costs. In other words, under the FCC's ARMIS rules, reporting carriers partition their costs into "interstate" and "intrastate" portions and report the interstate portion of their common line, switching, and transport revenues, expenses, and capital. Accordingly, we recover from these interstate costs the total costs incurred and reported by the ILECs. We discuss the recovery method in the following sections.

As for UNE prices for each state, we use those reported by Dr. Anna-Maria Kovacs, an investment analyst at Commerce Capital Markets, an investment bank subsidiary of Commerce Capital Bancorp, Inc. With the price estimates and our cost estimates we compute economic earnings per loop or line per month. Costs precisely equal to revenues would imply that the ILEC would have just earned a return commensurate with its costs when selling UNEs at prices indicated.

3.2 UNE Cost Analysis

In this section we describe the specific steps we have taken to compute costs associated with the common line, local switching, and switched transport that, in the aggregate, are associated with UNE-P costs. For the UNE-L, we begin with data in the Part 69 "common line" element.[24] The common line element contains the costs associated with the equipment (investments and expenses), direct labor, and indirect labor associated with the physical transmission path from the central office to the customers' premises for providing switched telephone services. For example, costs associated with the

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describes how one would go about computing the interstate earned (i.e., "actual/historical") rate of return. It therefore describes how one would go about creating a traditional regulatory cost-of-service model using the LEC's "actual" data. Part 69 also describes how costs are allocated among elements, such as common line, switching, and transport.

[24] Alternatively, one could begin with the data filed with the National Exchange Carriers Association ("NECA"). (Such data were once filed in the ARMIS 43-04 report.) However, these data are designed to identify high cost areas, and therefore they focus on loop costs. For example, this data set does not include switching costs, for which we would therefore have to rely on the 43-01 data in any case. Moreover, the data contain the implied FCC return on capital (weighted average cost of capital), and we wanted the flexibility to adjust this variable. For these reasons (and to use a consistent methodology across the common line, local switching, and switched transport elements), we opted to use the 43-01 data.

cables, conduits, cross connect boxes placed on street corners, and telephone poles (or shares thereof, if these are shared-use facilities) as well as labor costs, that have been incurred for digging trenches to place cable or to repair facilities and some supervisory and other overhead costs, are in common line accounts. Costs associated with non-switched services, data services, switching, and so forth are not included.[25] The local switching element includes all of the facilities and expenses, other than switched transport, associated with creating switched telephone services (e.g., dial tone, ability to call, central office features). Switched transport is used to transmit a call between the wire center and the long-distance carrier.

3.2.1   Unbundled Local Loop

Our analysis of costs of the unbundled local loop begins with the Common Line element in ARMIS. The common line includes investment in cable and wire, conduit, trenches, and telephone poles associated with the subscriber line. The common line element accounts for the investment and expenses incurred between the subscriber's network interface and the main distribution frame in the central office, and, as noted, includes only services associated with voice switches. We compute interstate operating expenses (including depreciation and amortization expenses) that are associated with the common line by summing the major (summary) categories of expenses other than interest expense and income taxes, which we compute.[26] We compute capital-related interest expenses, income taxes, and equity costs by multiplying Average Net Investment associated with the interstate portion of the common line by the FCC's estimate of RBOCs' weighted average cost of capital of 11.25

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[25]   ARMIS requires that the Common Line be defined as in Part 69 of the FCC's rules. (www.fcc.gov/wcb /armis/instructions/ 2002/ definitions01.htm#T1C.) Part 69.304 requires carriers to assigns investments local exchange lines to the Common Line element, and investment in interstate and foreign private lines to the Special access element. (Moreover, because we begin the analysis with the interstate portion of investment, that investment associated with intrastate private line has been directly assigned to the intrastate jurisdiction and is not included our computations. (See 47 CFR 36.3(a).) See, also 47 CFR 36.154(a) defining subscriber line or common line as those that are jointly used for local exchange service and exchange access for state and interstate interexchange services. In other words, investment and expenses associated with lines that fully or substantially are used for data services should not be reported in the common line element on which we base our analysis.

[26]   In our analysis, common line operating expenses exclude interest expenses, income taxes, and cost of equity capital, and depreciation and amortization expenses. These operating expenses are computed as Operating Expenses (line 1190) less Depreciation and Amortization Expenses (line 1180) plus Other Income (Losses) (line 1290), Non-Operating Items (line 1390), and Other State and Local Taxes (line 1420).

percent.[27] We compute income taxes by multiplying the weighed equity cost by Average Net Investment and by an income tax factor that reflects federal and state tax rates, and the deductibility of state income taxes at the federal level.[28]

The sum of the operating expenses (including depreciation and amortization expenses) and the capital-related costs (which include interest expense, income taxes, and the required equity return) represents "total" costs associated with the interstate portion of the common line.

The next step is to recover the entire (intrastate and interstate) costs of the common line. At present, the FCC rules require that 25 percent of the common line elements be allocated to the interstate jurisdiction. We recover total common line expenses and capital investment from the interstate portion by simply multiplying the interstate portion by 4, the inverse of the FCC's allocation ratio.[29]

Common line costs reported in ARMIS include expenses that are incurred at the retail level (e.g., marketing), and which would presumably not be associated with the ILEC's offerings of UNE-L or UNE-P. Therefore, the next step is to remove costs associated with the retailing function. There are basically two approaches to removing retail-related costs: a "tops down" approach that removes these costs by reducing total common line costs by the resale discount that is relevant to that carrier in that state,[30] or the "bottoms up" approach that seeks to identify specific ARMIS accounts (or parts of accounts) that contain retail-related expenses, and removing those. In theory, both approaches should produce similar results. We use the "tops down" approach and apply the resale discount established by the regulatory commission in each state to total common line costs for the carrier in that state, including the return portion of the costs.

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[27] The 11.25 weighted average cost of capital comprises a 13.2 percent cost of equity (and 55.8 percent equity weighting), and an 8.8 percent cost of debt (and 44.2 percent debt weighting). See, [[FCC CC Docket 89-624]]. We do not necessarily accept this cost of capital as accurately reflecting the true cost of capital of any specific ILEC; but rather use it here to avoid the controversy associated with this cost input. Later in this paper, we provide a sensitivity analysis that computes costs on the basis of a 10.25 percent and a 9.25 percent weighted average cost of capital.

[28] We assume a federal rate of 35 percent and state rates that vary by jurisdiction. As noted, the source of the state income tax rate data is www.taxadmin.org/fta/rate/corp_inc.html.

[29] See, ARMIS 43-04 report, line 1276.

[30] Under the terms of TA96, incumbent carriers must offer retail services at wholesale to CLECs for resale. The wholesale price for such resale services is to be set by subtracting from the carrier's retail price the per unit costs that the carrier would avoid if it were a wholesale rather than retail provider. In practice, this discount typically is determined as a percentage of the retail price. This is referred to as the "resale discount."

Finally, we compute per line costs by dividing total common line costs by the relevant number of lines, which include both retail and "wholesale" lines. Retail and resale switched lines are contained in ARMIS (report 43-08, line 2150). We increase this by the number of UNE-L and UNE-P lines to account for costs incurred (and reported by) ILECs for these lines. We compute an average number of UNE-L and UNE-P lines from data reported in the FCC's 2000 and 2001 Local Competition Reports. (Local Competition 2000 and 2001) We divide by 12 to get the monthly per line costs.[31]

3.2.2   Unbundled Local Switching

Our estimates of unbundled local switching costs are based on the local switching accounts in ARMIS. These include investment and expenses associated with switches, such as the land and buildings that house the switches, and the electricity that powers them. We derive the costs of Unbundled Local Switching using the same approach used for the unbundled loop. We aggregate the various summary expense accounts to arrive at total operating expenses (including depreciation and amortization expenses). We exclude interest expenses and income taxes, which we compute.

We compute interest expenses and equity costs by multiplying Average Net (Switching) Investment by the FCC's estimated weighted average cost of capital of 11.25 percent. Income taxes are computed as described earlier. The sum of the operating expenses (including depreciation and amortization expenses), interest, income taxes, and equity costs produces total local switching costs that the FCC associates with the interstate jurisdiction.

We recover total (interstate and intrastate) switching costs by applying the inverse of the ratio that the FCC applies to separate out the interstate costs. In the ARMIS 43-01 report, the FCC obtains local switching costs assigned to the interstate jurisdiction by allocating expenses and investment on the basis of how much the local switch is used to switch calls that ultimately are billed as interstate calls (ARMIS 43-04 line 1216).[32] Accordingly, we recover our "total" company switching costs by multiplying the interstate portion of switching costs by the ratio of total minutes to interstate minutes.[33]

To derive switching costs per loop or line, we divide total switching costs by the sum of retail switched lines, resale lines, and UNE-P lines. We do

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[31]   We also convert from data stated in thousands of dollars to a per-line per month rate in whole dollars (and cents) by multiplying the data by 1000.

[32]   Local switching expenses and investment associated with non-regulated services are not subjected to the allocation process, but instead are directly assigned to the non-regulated category. See, 47 CFR 36.125 (3) (b). Such directly assigned investments and expenses are small relative to the overall local switching investment.

[33]   We use the ratio of total dial equipment minutes ("DEM") to interstate DEM as provided in ARMIS as our factor for grossing up switching expenses.

not include UNE-L lines because these lines use CLEC switching. We do not adjust the switching category by any resale discount because Interstate Local Switching in the ARMIS 43-01 report is a wholesale-only operation and does not include any retailing costs.

3.2.3 Unbundled Switched Transport

Unbundled switched transport costs are estimated using ARMIS data for the switched transport element. Switched transport data in the ARMIS accounts include the investment and expenses associated with the transmission of calls from the ILEC to the IXC. These investments (and expenses) are those associated with fiber optic cables, multiplexers, conduits, and poles. Unbundled switched transport costs are computed from ARMIS similarly to the method we used for estimating the costs of unbundled local switching. One difference is the method by which we gross up to total (interstate and intrastate) costs from the interstate portion. Whereas for switching we multiply the interstate portion of costs by the ratio of total-to-interstate minutes, here we compute total switched transport costs by multiplying the interstate portion by one-half the ratio of total-to-interstate minutes. Halving the ratio has the effect of halving the total switched transport costs extracted from the interstate portion.

The reason for this adjustment relates to differences between IXC-imposed switched transport costs that are reported in ARMIS and the CLEC-imposed switched transport costs that we wish to estimate. A typical interstate call requires on the order of one transport link between the ILEC and IXC. In contrast, a substantial portion of CLEC (and ILEC) local exchange calls are intraswitch (i.e., the caller and called party are served by the same switch) and no transport link is required.[34] Dr. Kovacs estimates that approximately 25 percent of calls are intraswitch and require no interoffice transport. (Kovacs May 2002) Accordingly, ARMIS-based transport costs would be reduced something on the order of 25 percent to provide an estimate of transport costs associated with CLEC customers. To be conservative, we use one-half of the total transport costs associated with interstate calling to account for this cost difference.

We compute per-line switched transport costs by dividing total switched transport costs by the same number of lines that we used in the derivation of switching costs per line.

3.3 UNE Price Analysis

The identification of the relevant UNE prices in each state is non-trivial, and summarizing them into a "price" for each state requires the application of a variety of assumptions. UNE prices typically consist of an array

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[34] This is true for calls that are carried entirely on the ILEC's network, including UNE-P calls. Calls that are handed off to a CLEC (such as when a CLEC uses UNE-L) are never intraswitch calls, but because our cost estimates for switched transport applied to UNE-P costs only, it is appropriate to consider intraswitch calls.

of rate elements for different network elements (for example, there are different prices for loops of different capacities) and different components of network elements. Switching prices may, for example, consist of a fixed monthly charge and a per-minute usage charge. Interoffice transport prices may vary by length of the transport. In addition, loop prices typically vary by geographic zone or area, which are intended to reflect different cost characteristics such as loop length and density. However, ARMIS cost data are reported on a "study area" basis, and study areas generally conform to statewide service territories. Hence, to determine a single UNE "price" to compare to the cost analysis, one must make assumptions about the relative weights of the geographic zones, the average amount of call time, the number of months over which non-recurring (fixed) charges should be amortized, and other factors, in ways that are consistent with the cost data.

As mentioned, our study uses the price estimates provided by Dr. Anna-Maria Kovacs of Commerce Capital Markets. During the 2001-2002 period, Dr. Kovacs issued five major reports on UNE prices.[35] According to Dr. Kovacs, she sought, and received, input from companies and state regulatory commission staffs on the accuracy of her collection of UNE prices.[36] We examined a number of Dr. Kovacs' prices (i.e., for Texas, California, Michigan, Illinois, and Indiana) and found them to be comparable to our own calculations of UNE prices in these states. We also compared Dr. Kovacs' prices to UNE prices presented by AT&T in an *ex parte* submission to the FCC during the Triennial Review proceeding, and found them to be substantially the same.[37] We also found the CCM prices to be reasonably consistent with the type of assumptions that underlie the ARMIS cost data. We use the prices as described in her most recent report, which is dated November 2002.

Since that time it is possible, and even likely, that some UNE prices have changed. According to Dr. Kovacs' discussions in her five UNE price studies, the trend generally has been downward as ILECs have sought in-region long-distance authority under the Act and have had their UNE prices set by state

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[35] This includes the aforementioned Kovacs (May 2002) and also Anna-Maria Kovacs (2001), Kovacs (April 2002), Kovacs (August 2002), and Kovacs (November 2002).

[36] "We have sought to ascertain the cost of UNEP by using a variety of sources. Where possible, we have consulted the actual tariffs or interconnection agreements. We have also received input, with various degrees of completeness, from the RBOCs, some CLECs, and many state commissions, both for the original report we published in November of 2001 and for this iteration. That input has been both about actual UNE rates and about usage assumptions that might be appropriate." (Kovacs April 2002, 6)

[37] The minor differences that we found likely are due to different assumptions about usage or line weightings. Our analysis determined that those AT&T UNE-L and UNE-P prices that differed by more than a few percentage points from the CCM prices failed to reflect more recent state updates of the UNE prices. See, AT&T (2002).

commissions and then reviewed by the FCC. (Kovacs August 2002, 1) Moreover, we are unaware of any instance where UNE prices have been increased by a state commission. Accordingly, our conclusions that UNE costs exceed UNE prices are bolstered by subsequent downward price movements not already reflected in the CCM price data.

The CCM price analysis incorporates (1) loop prices (by rate zone and retail-line-weighted by rate zone), (2) local switching, (3) other switching and transport rates,[38] and (4) "all other" (which includes the Daily Usage Feed ("DUF"),[39] feature costs (if any), and non-recurring charges ("NRCs"). The CCM studies amortize NRCs over 36 months. (Kovacs May 2002, 11) According to information that we have been provided by one ILEC, the use of a 36-month customer life to compute an average price is consistent with the cost assumptions implicit in the underlying ARMIS data.[40]

In each instance, we seek to identify price elements that match the cost items in ARMIS and we seek to conform the structure of the price to the structure of the ARMIS-based cost data. In other words, we seek to use the same traffic, density, and distance (i.e., area) assumptions to develop the UNE price estimates that are used to develop the UNE cost estimates. This approach ensures a meaningful price-to-cost comparison.

In contrast, approaches that use CLEC-related data do not ensure a meaningful price-to-cost comparison when costs are based on ARMIS data. The reason is that cost estimates that are based on ARMIS data are shaped substantially by the ILEC's experience (rather than the CLECs'), because the ILEC serves substantially more retail customers than it does CLEC customers (through resale, UNE-L, and UNE-P). The relevant revenues (per line, per minute, or on a non-recurring basis) are those that match the way costs were incurred by the ILEC in providing those items related to UNEs (i.e., common line, switching, and switched transport).

There are several instances where the general rule of matching underlying cost assumptions to the revenue assumptions can create differences between what a CLEC might actually pay to the ILEC for UNEs and what UNE price is relevant to a cost evaluation that uses ARMIS data. For example, the issue is important when developing recurring loop costs. These costs depend on the distance that the customer is from the ILEC switching center and on number of customers within that same area (i.e., density). As previously noted, state

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[38]   Kovacs (November 2002) computes the switching and transport prices two ways. The first uses 1400 minutes for each user, which is designed to enhance cross-sectional price comparability. The second uses the particular state jurisdiction's dial equipment ("DEM") minutes, which more accurately reflects cost. We use the switching and transport prices developed on the basis of DEM minutes.

[39]   The DUF is a daily usage record of calls that is provided by the ILEC to the CLEC.

[40]   If an ILEC's overall weighted average turnover is greater than 36 months, the CCM estimate method would contribute to an overstatement of non-recurring revenues relative to the actual cost experience.

regulatory commissions generally permit ILECs to account for these cost differences in their UNE loop prices by charging more for lengthy runs in rural areas than for short runs in dense, urban areas, so it is important to ensure that the mix of loops in the revenue computation is the same as the mix in the cost estimation.

The issue of comparability between price and cost also arises in the development of non-recurring charges. NRCs are one-time charges to the CLEC to recover costs associated with (e.g.) ordering and provisioning of the UNE. The ILEC also incurs non-recurring costs when it provisions lines to its retail customers. The ILEC's costs associated with non-recurring activities vary by the "churn" of customers and whether the ILEC must provision a new line to serve a new customer, or whether the ILEC can simply use an existing line.[41]

As before, the price should be developed to match the ILEC's churn because it is the latter that is implicit in costs reported in ARMIS. To see this, suppose the non-recurring cost were, for simplicity, $1 each time a new customer is set up on the network. If an ILEC customer typically lasts for four years, then the ILEC's average non-recurring cost per line per year would be 25¢ (2¢ per month), because it incurs the non-recurring cost only once every four years, on average. If a CLEC's customer typically lasts for six months, the average non-recurring charge per line per year should be $2 (17¢ per month), because the carrier imposes such costs on the ILEC twice a year. Both the non-recurring costs and the non-recurring revenues should be amortized over the proper customer life. Hence, the CLEC's booked costs when it buys UNE-P would be $2.00 per year (if prices were cost based); but the proper comparison against ARMIS costs would calculate the UNE-P price assuming 25¢ per year. The latter assumption would permit a more accurate comparison against ARMIS costs to assess whether prices reasonably cover the ILEC's actually incurred costs.

It is likewise the case that one should include in the price estimate those items for which a corresponding cost has been estimated and should exclude in the price those items for which no costs are estimated. For this reason we exclude, for example, operator service and directory assistance ("OS/DA") revenues, even though some CLECs may pay an ILEC for these services. Neither OS nor DA is a UNE, so it is appropriate to exclude both from the cost and revenue analysis.[42] We exclude OS from the cost analysis by using the Part 69 (common line, local switching, and switched transport) categories, since OS for toll calls is not allocated to any of those three categories. We exclude DA cost, by excluding the "information" category of ARMIS (which is where DA costs are booked) from our cost analysis.

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[41] A new customer that causes the ILEC to install a new line imposes more costs on the ILEC than does a new customer that can be served with an existing line. Similarly, a CLEC that seeks to serve customer in a way that requires the ILEC to install a new line imposes more costs on the ILEC than if the line exists and the customer can be "migrated" to the CLEC.

[42] OS/DA are not UNEs. CLECs may purchase these as retail services. (UNE Remand Order, ¶¶ 441-442)

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3.4   Cost and Price Comparisons

3.4.1   The Base Case Results

Figure 1 shows that in 44 of 48 states, UNE-P prices are less than UNE-P costs, often by substantial amounts. The largest dollar deficit in 2001 was in Arkansas, where costs exceed price by about $22.35. In other words, in Arkansas, cost exceeded price by a factor of 2. On a line-weighted-average basis,[43] over all 48 jurisdictions, costs exceed price by about $10.74 per UNE-P per month.[44] On a line-weighted average basis nationwide, ILECs would have to reduce their costs by about 35 percent to eliminate the current price-cost deficit; but this average does not apply evenly across all states. ILECs in Arkansas, Illinois, New Jersey, New York, and Ohio would have to reduce their costs by approximately 50 percent to have the opportunity to earn a compensatory return at current UNE-P prices. (See Table 2.)

Figure 1: Unbundled Network Element Prices and Costs for the UNE-Platform
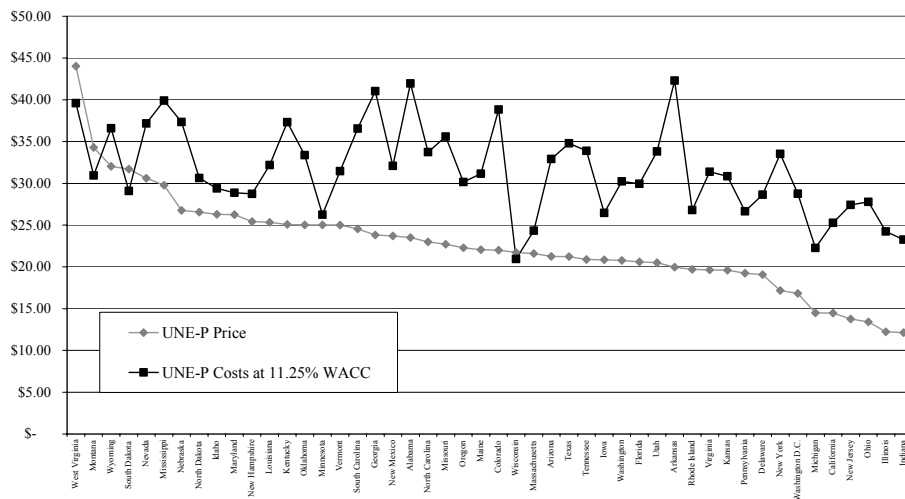
Sources:
Prices are from *CCM November 2002* . Costs are computed from 2001 ARMIS data by the authors.

[43]   We weight by the aggregate of retail, UNE-P, and resale lines.

[44]   The line-weighted average UNE-P cost based on 2001 ARMIS data is $30.04, and the weighted average UNE-P price, based on Kovacs (November 2002), is $19.30.

Table 2: UNE-P Prices and Costs (Part 1 of 2)			
State	Price	Cost at 11.25% WACC	Surplus (Deficit)
BellSouth			
Alabama	$ 23.52	$ 41.94	$ (18.42)
Florida	$ 20.59	$ 29.95	$ (9.36)
Georgia	$ 23.83	$ 41.04	$ (17.21)
Kentucky	$ 25.08	$ 37.32	$ (12.24)
Louisiana	$ 25.34	$ 32.19	$ (6.85)
Mississippi	$ 29.79	$ 39.91	$ (10.12)
North Carolina	$ 22.98	$ 33.75	$ (10.77)
South Carolina	$ 24.54	$ 36.57	$ (12.03)
Tennessee	$ 20.88	$ 33.88	$ (13.00)
Qwest			
Arizona	$ 21.25	$ 32.91	$ (11.66)
Colorado	$ 22.00	$ 38.83	$ (16.83)
Idaho	$ 26.27	$ 29.38	$ (3.11)
Iowa	$ 20.84	$ 26.48	$ (5.64)
Minnesota	$ 25.02	$ 26.26	$ (1.24)
Montana	$ 34.30	$ 30.93	$ 3.37
Nebraska	$ 26.76	$ 37.34	$ (10.58)
New Mexico	$ 23.71	$ 32.09	$ (8.38)
North Dakota	$ 26.55	$ 30.63	$ (4.08)
Oregon	$ 22.29	$ 30.15	$ (7.86)
South Dakota	$ 31.71	$ 29.09	$ 2.62
Utah	$ 20.52	$ 33.80	$ (13.28)
Washington	$ 20.77	$ 30.25	$ (9.48)
Wyoming	$ 32.02	$ 36.60	$ (4.58)

Table 2: UNE-P Prices and Costs (Part 2 of 2)			
State	Price	Cost at 11.25% WACC	Surplus (Deficit)
SBC			
Arkansas	$ 19.96	$ 42.31	$ (22.35)
California	$ 14.48	$ 25.27	$ (10.79)
Illinois	$ 12.22	$ 24.24	$ (12.02)
Indiana	$ 12.15	$ 23.25	$ (11.10)
Kansas	$ 19.60	$ 30.85	$ (11.25)
Michigan	$ 14.50	$ 22.27	$ (7.77)
Missouri	$ 22.72	$ 35.60	$ (12.88)
Nevada	$ 30.63	$ 37.16	$ (6.53)
Ohio	$ 13.42	$ 27.78	$ (14.36)
Oklahoma	$ 25.03	$ 33.36	$ (8.33)
Texas	$ 21.22	$ 34.79	$ (13.57)
Wisconsin	$ 21.73	$ 20.95	$ 0.78
Verizon			
Delaware	$ 19.06	$ 28.64	$ (9.58)
Maine	$ 22.07	$ 31.14	$ (9.07)
Maryland	$ 26.25	$ 28.88	$ (2.63)
Massachusetts	$ 21.61	$ 24.33	$ (2.72)
New Hampshire	$ 25.42	$ 28.74	$ (3.32)
New Jersey	$ 13.75	$ 27.41	$ (13.66)
New York	$ 17.17	$ 33.53	$ (16.36)
Pennsylvania	$ 19.23	$ 26.65	$ (7.42)
Rhode Island	$ 19.69	$ 26.81	$ (7.12)
Vermont	$ 24.99	$ 31.46	$ (6.47)
Virginia	$ 19.65	$ 31.38	$ (11.73)
Washington D.C.	$ 16.83	$ 28.76	$ (11.93)
West Virginia	$ 44.02	$ 39.59	$ 4.43
Wtd. Avg. All States	$ 19.30	$ 30.04	$ (10.74)

We also computed the costs related to the UNE-L, which are displayed in Figure 2 and Table 3. These exhibits show that in only six instances does the 2002 UNE-L price at least meet the costs incurred by the firm in 2001 to supply UNEs. On a line-weighted average basis, the UNE-L price of $12.86 was approximately $6.18 less than the 2001 costs incurred to provide UNE-Ls.

Figure 2: Unbundled Network Element Prices
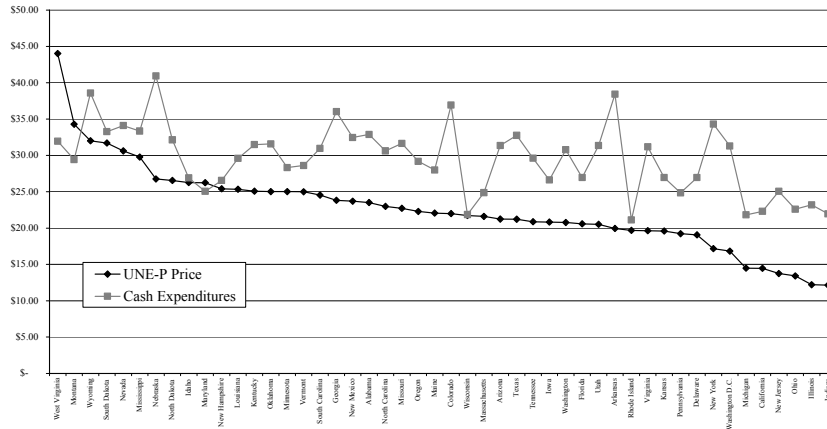## and Costs for the UNE-Loop
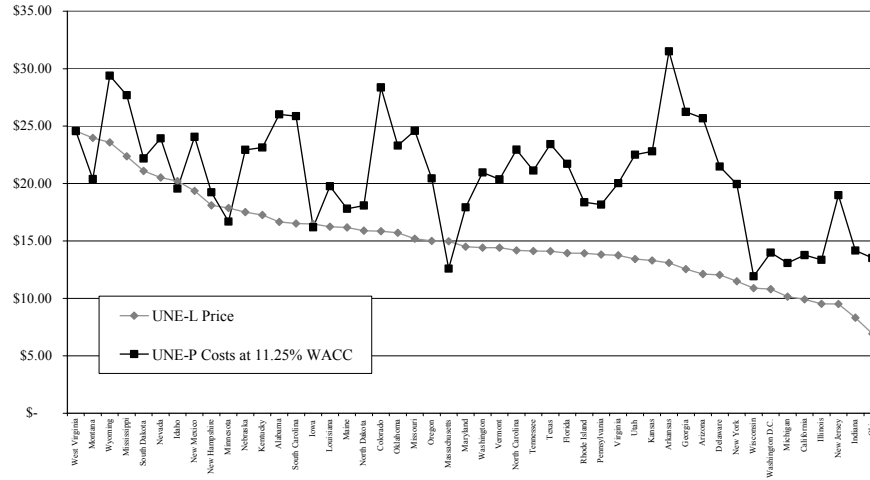
Sources:
Prices are from *CCM November 2002* . Costs are computed from 2001 ARMIS data by the authors.

Table 3: UNE-L Prices and Costs (Part 1 of 2)			
State	Price	Cost at 11.25% WACC	Surplus (Deficit)
BellSouth			
Alabama	$ 16.66	$ 26.01	$ (9.35)
Florida	$ 13.95	$ 21.72	$ (7.77)
Georgia	$ 12.55	$ 26.23	$ (13.68)
Kentucky	$ 17.26	$ 23.14	$ (5.88)
Louisiana	$ 16.24	$ 19.76	$ (3.52)
Mississippi	$ 22.37	$ 27.68	$ (5.31)
North Carolina	$ 14.18	$ 22.95	$ (8.77)
South Carolina	$ 16.51	$ 25.86	$ (9.35)
Tennessee	$ 14.12	$ 21.13	$ (7.01)
Qwest			
Arizona	$ 12.12	$ 25.68	$ (13.56)
Colorado	$ 15.86	$ 28.36	$ (12.50)
Idaho	$ 20.21	$ 19.56	$ 0.65
Iowa	$ 16.47	$ 16.20	$ 0.27
Minnesota	$ 17.87	$ 16.69	$ 1.18
Montana	$ 23.98	$ 20.39	$ 3.59
Nebraska	$ 17.51	$ 22.94	$ (5.43)
New Mexico	$ 19.36	$ 24.07	$ (4.71)
North Dakota	$ 15.90	$ 18.08	$ (2.18)
Oregon	$ 15.00	$ 20.45	$ (5.45)
South Dakota	$ 21.09	$ 22.19	$ (1.10)
Utah	$ 13.43	$ 22.51	$ (9.08)
Washington	$ 14.41	$ 20.96	$ (6.55)
Wyoming	$ 23.58	$ 29.39	$ (5.81)

| Table 3: UNE-L Prices and Costs (Part 2 of 2)			
State	Price	Cost at 11.25% WACC	Surplus (Deficit)
SBC			
Arkansas	$ 13.09	$ 31.50	$ (18.41)
California	$ 9.93	$ 13.78	$ (3.85)
Illinois	$ 9.53	$ 13.36	$ (3.83)
Indiana	$ 8.32	$ 14.17	$ (5.85)
Kansas	$ 13.30	$ 22.80	$ (9.50)
Michigan	$ 10.16	$ 13.08	$ (2.92)
Missouri	$ 15.19	$ 24.59	$ (9.40)
Nevada	$ 20.52	$ 23.92	$ (3.40)
Ohio	$ 6.93	$ 13.53	$ (6.60)
Oklahoma	$ 15.71	$ 23.30	$ (7.59)
Texas	$ 14.11	$ 23.44	$ (9.33)
Wisconsin	$ 10.90	$ 11.93	$ (1.03)
Verizon			
Delaware	$ 12.05	$ 21.48	$ (9.43)
Maine	$ 16.18	$ 17.81	$ (1.63)
Maryland	$ 14.50	$ 17.93	$ (3.43)
Massachusetts	$ 14.98	$ 12.60	$ 2.38
New Hampshire	$ 18.10	$ 19.23	$ (1.13)
New Jersey	$ 9.52	$ 18.98	$ (9.46)
New York	$ 11.49	$ 19.95	$ (8.46)
Pennsylvania	$ 13.81	$ 18.16	$ (4.35)
Rhode Island	$ 13.93	$ 18.37	$ (4.44)
Vermont	$ 14.41	$ 20.36	$ (5.95)
Virginia	$ 13.76	$ 20.02	$ (6.26)
Washington D.C.	$ 10.81	$ 13.98	$ (3.17)
West Virginia	$ 24.58	$ 24.55	$ 0.03
Wtd. Avg. All States	$ 12.86	$ 19.04	$ (6.18)

These cost estimates, as explained, are "all-in" costs—they include operating costs, depreciation of capital, interest expenses, taxes, and a normal return to equity. However, it turns out that in most instances, the UNE-P and UNE-L prices are not sufficient even to permit the ILEC to recover its out-of-pocket cash outlays. Figures 3 and 4 show the sum of operating expenses (which, in this study, exclude depreciation and amortization expenses, and therefore approximate cash operating expenses) and cash capital expenditures versus the UNE-P and UNE-L prices, respectively. In approximately 90 percent of the states, UNE-P and UNE-L fail to cover ILEC cash costs.

Figure 3: Unbundled Network Element Prices and Cash Expenditures for the UNE-P

Figure 4: Unbundled Network Element Prices and Cash Expenditures for the UNE-L
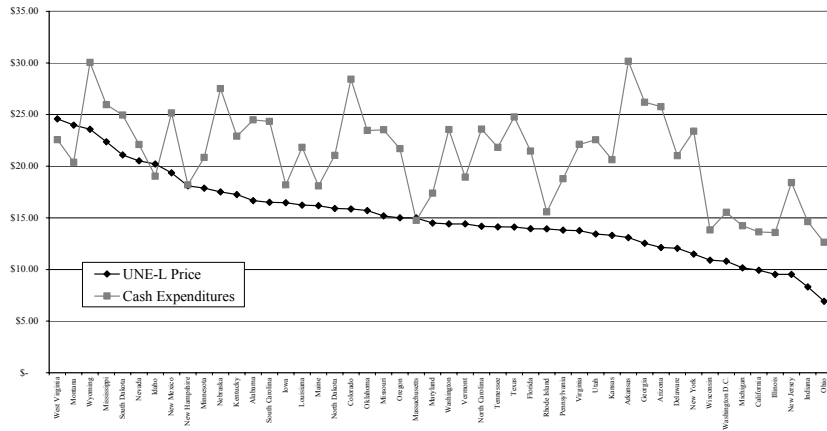
We compute the cash costs (before taxes and interest) by adding cash capital expenditures to our operating expenditures, which, as noted earlier, exclude depreciation and amortization expenses, and so are representative of cash costs.[45] We obtain cash capital expenditures from the ARMIS 43-02 report (Statement of Cash Flows, line 240, Construction/Acquisition of Property, Plant & Equipment). ARMIS data do not segregate the ILEC's cash capital expenditures into the common line, local switching, and switched transport elements. Accordingly, these capital expenditures include spending not only on items related to UNEs, but also to those related to (e.g.) the provision of data services. Moreover, the cash capital expenditures are reported in ARMIS on the basis of the legal entity, which in some instances (such as the former Southwestern Bell states) is an aggregate of multiple states. We therefore allocated cash capital expenditures to the individual states on the basis of gross telephone plant in service. These features of the ARMIS data reduce the accuracy of measurement for our purposes, but we believe that they remain indicative of the true financial impact of UNE prices.[46] Moreover, the cash expenditure analysis considered here is something short of a "free cash flow"[47] computation because our cash costs do not include financing costs (i.e., interest expenses or dividends) or income taxes.[48] Although the results can only be suggestive, it nevertheless is worth noting that in fewer than half a dozen instances (out of 48) do UNE-P prices or UNE-L prices cover the aggregate of operating and capital expenditures.

One may debate depreciation rates and returns on capital, but the fact that revenues fail to cover out-of-pocket cash expenditures should be a clear signal that a business model under which the ILEC sells unbundled network elements at the currently effective prices is unsustainable in most states. In reviewing evidence regarding UNE prices for SBC Illinois that one of the authors presented to the Illinois General Assembly (that likewise showed the

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[45] We did not make any adjustments to account for changes in the timing of receipts and disbursements that, in principle, could affect cash operating expenses.

[46] Most of an ILEC's plant is related to the categories associated with UNE-P, and a substantial portion of capital expenditures is related to maintaining these network components. Also, as a check, we found that year-over-year (2000-01) changes in UNE-related TPIS in California accounted for over 90 percent of 2001 cash capex. This proportion will vary from year to year. It also represents a *minimum* to the proportion of new capital devoted to UNE-P-related elements.

[47] Free cash flow is defined as the cash generated by a business in excess of its cash expenditures, including expenditures on capital. (Brealey 2002, 77-78) Free cash flow would account for interest expenses, income taxes, and dividends (if they normally are paid). Our cash flow computation does not attempt to measure all of these items, but instead simply provides an indication of the cash needs related to operating the business.

[48] Our cash analysis does not include uncollectibles. If included, uncollectibles would reduce the net cash flow to the ILEC.

ILEC, SBC Illinois, was losing a significant amount of money on out-of-pocket, cash expenditures), the eminent regulatory economist, and former chairman of the New York Public Service Commission, Professor Alfred Kahn, testified to the Illinois Legislature that:

> I find such a situation astounding. As a regulator, I could not possibly have justified setting any rates—unless they were explicitly subsidized by other rates—at such a level that it would require the company to lose huge numbers of dollars out-of-pocket, unless I had made some sort of a positive finding that its management was almost criminally negligent. (Kahn 2003)

3.4.2 Interpreting the Base Case Results

In *Verizon*, the Supreme Court concluded that the "hypothetical" network element is "simply the element valued in terms of a piece of equipment an incumbent may not own." (Verizon 2002, *65) The UNE-P prices that we examined show that such as-yet unowned equipment would have to cause ILEC costs to fall by, on average, about one-third to reach breakeven with existing average UNE-P and UNE-L prices.[49]

It is worth considering, therefore, the nature of the cost savings that these hypothetical pieces of equipment would have to provide. For example, the average ILEC incurred about $12.38 per month in 2001 in (cash) operating expenses (i.e., excluding depreciation and amortization expenses, excluding interest expense, and excluding income taxes, but including taxes other than income taxes) to provide a UNE-P line. A UNE-P price-to-cost deficit of $10.74 represents about 87 percent of these average ILEC operating expenses. That is, an ILEC would have to reduce its operating expenses by about 84 percent, all else the same, to obtain breakeven. We believe that this alone demonstrates that (the average) UNE-P price reflects wishful thinking about costs on average across states, and that it does not properly account for all forward-looking costs associated with a realistic, though hypothetical, firm. Alternatively, one can consider that the weighted-average UNE-P price-to-cost deficit of $10.74 represents about two-thirds of the 2001 capital spending ($15.63 per line per month) of the average ILEC.

Looked at differently, consider an ILEC whose productivity were such that it could reduce its costs by 6 percent per year in nominal terms, and that

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[49] Indeed, the equipment, techniques, and policies of the hypothetical firm would have to reduce costs by *more* than a third percent because, under the TELRIC methodology, other costs, such as those associated with land, where ILEC book generally is less than forward-looking cost (at least on a per-unit basis), would be adjusted upward. Hence, (all else the same) the hypothetical firm would incur higher land costs than appear on the ILEC's books, requiring cost savings in excess of one-third percent in other areas to reach the overall cost savings target.

there is no inflation.[50] It would take over seven years for the ILEC's average costs to decline to the average UNE-P price. Thus, the average "hypothetical" firm that is assumed to have achieved such efficiencies today is presumed to operate with the cost structure that the ILEC would not attain, under these conditions, until at about 2010.

3.4.3 Interpreting the Base Case Results via the "Admissibility Test"

We earlier mentioned Lehman and Weisman's admissibility test that could be used to compare the TELRIC-based UNE-P (and UNE-L) prices to the corresponding actual, booked costs to determine whether the prices reasonably are based on forward-looking costs, or whether they are based simply on wishful speculation about future costs. Here, we apply the admissibility test to our cost computations.

According to Lehman and Weisman, three key factors—technological change, the use of the annual capital charge factor ("ACCF") method[51] rather than the traditional regulatory cost of capital approach,[52] and different depreciation periods (with economic depreciation typically involving shorter lives than regulated depreciation)—are essential differences between forward-looking and book-derived costs. (Lehman and Weisman 2000, 74) Lehman and Weisman (2000, 74) perform a simulation comparing forward-looking and actual costs using "realistic parameter values" to specify the simulation model. The authors conclude that the potential differences between forward-looking and book-based costs can be quantified and bounded, as shown in Table 4. Table 4 also shows the results of our study (column 3). Clearly, the actual prices deviate from prices far more than predicted by the admissibility test.

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[50] The FCC's price cap plan reflects an assumption that ILECs can increase their productivity by 6 percent per year (excluding the consumer productivity dividend of 0.5 percent). (Price Caps Order)

[51] The annual capital charge factor approach calculates the value $X such that if $X were received each year over the life of an investment whose initial cost is $1.00, the discounted present value of the annuity stream would equal $1.00. The ACCF method therefore accounts for both a return on invested capital and a return of that investment. (The ACCF method can also account for income taxes, changes in prices of the assets, and other factors.)

[52] In contrast to the ACCF approach, the traditional cost of capital approach computes a return on capital by multiplying the rate base (e.g., Average Net Investment, possibly with some regulatory adjustments) by the weighted average cost of capital. Return of capital is derived separately through the derivation of depreciation expense. (Morin 1984, 5)

Table 4: Ranges for the *Lehman and Weisman* Admissibility Test		
Percent Excess of Booked over Forward-Looking Costs	Percent of Study Areas that Should Fall within the Range: >=(per Lehman and Weisman)	Percent of Study Areas that Actually Fall within the Range (based on 2001 ARMIS Data)
4% to 13%	50%	13%
-0.5% to 17.5%	80%	15%
-4% to 19%	90%	19%
Source: Lehman (2000, 76) *and authors' computations.*		

According to the admissibility test, in a random sample of study areas (e.g., states), one would expect about 90 percent of forward-looking cost studies to fall within a range in which actual costs were on the order of –4 percent less to 19 percent more than forward-looking costs. If this is not the case, that is, if one finds far fewer than 90 percent of the study areas in that range, one can conclude that the studies reflect differences other than a forward-looking adjustment. Table 4 shows that only 19 percent of the states (not 90 percent) fell within that range, indicating that state commissions likely do not base UNE prices on genuinely forward-looking costs. In fact, there is less than a 1 percent chance that the average of the states' "TELRIC"-based UNE prices would diverge from actual cost by more than 11.5 percent if the UNE prices reflected only a reasonable adjustment for the forward-looking perspective.[53] However, we estimate that the states' UNE prices diverge from actual costs by over 30 percent. Accordingly, there is virtually no chance that the UNE prices actually observed in the states reflect the process of adjusting actual costs to render them forward looking. Any additional differences between prices and costs must reflect assumptions about ILECs' "inefficiencies," despite the facts that we have already observed (1) that carriers are largely operating under incentive regulation already, which creates powerful incentives for efficient operations; and (2) that the productivity gains implied by the extant UNE rates far exceed any gains that the FCC believes can actually be achieved. Hence, it appears that the differences that are attributed to "inefficiencies" are in fact unrelated to any efficiencies that can demonstrably or reasonably be achieved in the real world.

Figure 5 illustrates the admissibility test using the broadest of categories (i.e., -4 percent to 19 percent), in which one would expect to find 90 percent of the studies, for our UNE-P analysis. The Figure shows that, in fact, only nine of 48 states fall within the band. Three states have UNE-P prices that are "too high" relative to the admissibility test, and 36 states fall outside of the admissibility test's low end. Thus, according to the Lehman and Weisman

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[53] This statistic is derived from the fact that the standard deviation of the simulation distribution is 7.35% and the distribution is approximately normal, which information was obtained from Dr. Lehman via personal communication.

criteria, to the extent that state regulatory commissions followed a particular approach, that approach was not a properly specified TELRIC study.

3.5   Sensitivities and Alternatives

In this section we evaluate the impact of a different weighted average cost of capital; an alternative method of computing capital-related costs that derives an annualized flow of costs based on a stock of capital; and the effect of an alternative approach to eliminating retail-related costs from the UNE cost computations. Clearly, if we were to assess the effect of a higher weighted average cost of capital, our results would be reinforced. Higher cost of capital results in higher estimates of total (actual) costs, and the deviations from UNE prices that we have already demonstrated would only increase. Hence, rather than performing sensitivity analysis on higher costs of capital, we report only on sensitivity with respect to still lower costs of capital. It may well be that the weighed cost of capital applicable to any given ILEC is higher than the FCC's estimate which we applied here; in that case, the underpricing would be that much more severe.

3.5.1   Sensitivity of Results to the Weighted Average Cost of Capital

Our analysis uses the FCC's 11.25 percent weighted average cost of capital. To assess the sensitivity of our results to the assumed cost of capital, we recompute costs based on a 10.25 percent cost of capital (assuming a reduction in equity costs from 13.2 percent to 11.41 percent). As Table 5 shows, a

Figure 5: Unbundled Network Element Admissibility Test for the UNE-Platform
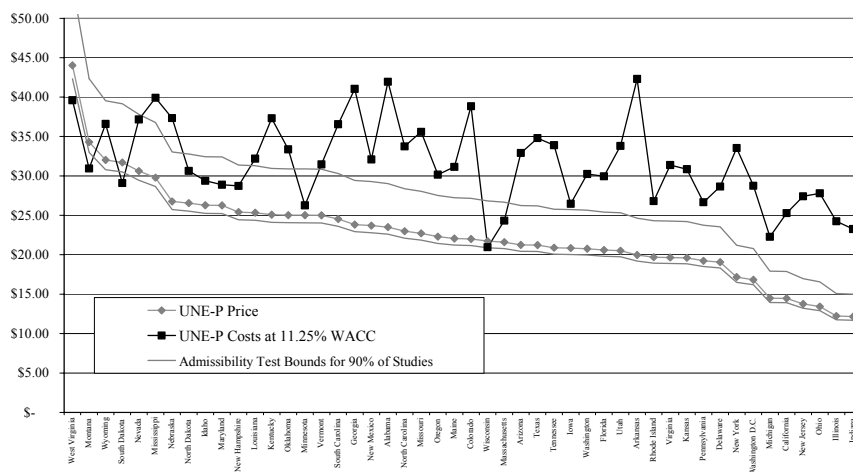
Sources:
Prices are from *CCM November 2002* . Costs are computed from 2001 ARMIS data by the authors.

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reduction in the cost of capital from 11.25 percent to 10.25 percent reduces the line-weighted national average UNE-P cost from $30.04 to $29.27. The conclusion that UNEs are underpriced remains. The number of states whose UNE-P prices fall within Lehman and Weisman's 90 percent bands remains unchanged. When we use a 9.25 percent weighted average cost of capital (by decreasing equity cost), the UNE-P prices of an additional two states fall within Lehman and Weisman's 90 percent bands.

Table 5: Sensitivity Analysis on Weighted Average Cost of Capital and 2001 ARMIS Cost Data Average for 47 States plus Washington D.C.			
	WACC	UNE-L Cost	UNE-P Cost
FCC Benchmark	11.25%	$ 19.04	$ 30.04
Sensitivity 1	10.25%	$ 18.53	$ 29.27
Sensitivity 2	9.25%	$ 18.02	$ 28.50
The FCC WACC is reduced by decreasing equity costs.			

3.5.2   An Alternative Approach to Capital-Related Costs

The computations reported above were based on the "traditional" approach to determining capital costs—traditional in the sense that we used the method that was typically employed in regulatory rate cases. The traditional approach uses book depreciation as the measure of return "of" capital, and the weighted average cost of capital multiplied by Average Net Investment as the return "on" capital. Income taxes are based on effective federal and state rates and the equity portion of the return. In this section, we discuss the effects of using an alternative approach to estimating capital-related costs.

For purposes of explaining our alternative approach to estimating capital costs, we ignore income taxes (although we incorporate these taxes in our actual computations). Our formula using the "traditional" approach can be expressed as follows:

For each year t,

$$K_t = D_t + rANI_t \qquad \textbf{(1)}$$

This equation says that investors are compensated for capital-related costs in each year t if the income that they receive equals (K_t), which allows for the recovery of their investment through payments to investors equal to the asset's depreciation in that year (D_t), and it allows for the recovery on remaining investment, through payments that reflect the carrying cost, or weighted average cost of capital (r) multiplied by the portion the investment that is undepreciated, of Average Net Investment (ANI_t).[54]

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[54]   In ARMIS, Average Net Investment (See, 43-01 report, line 1910), equals Total Plant in Service ("TPIS") less accumulated depreciation and amortization and less other credits and contra-assets, using a thirteen month

Under this method, for a given asset, cost recovery is not levelized. For example, consider an asset whose original cost is $1,000 and which has an economic life of 10 years with no salvage value. Assuming that the risk-adjusted cost of capital is 10 percent, at the end of year 1, using the traditional approach, the investor would receive payment of $195 for the use of the asset, with $100 of that payment representing return "of" the asset through depreciation expense and $95 of that payment represent return "on" the (average) amount invested during the year.

$$K_1 = \$100 + 10\% \times \$950 = \$195.$$

At the end of year 2, the investor would receive $185:

$$K_2 = \$100 + 10\% \times \$850 = \$185.$$

This progression would continue so that in year 10, the investor would receive $105 dollars ($100 for depreciation, and $5 representing the return on the average of the outstanding balance of the investment). If the firm then replaced the asset, this process would begin again, thereby producing a sawtooth pattern of costs to the firm and returns to the investor. In a steady state, wherein the firm uses assets of many different vintages and where assets are purchased and retired every year, the sawtooth pattern is smoothed. Thus, where a firm's portfolio of assets comprises overlapping generations so that total costs in any particular year are the same, there would be no sawtooth pattern of returns. The cost in each year would be the (undiscounted) average of the annual payments, which in this example is $150.

An alternative approach to determining an appropriate flow of asset costs from a stock of capital is to use the ACCF method that we described earlier. This method determines the "annuity" that jointly accounts for the life of the asset (depreciation) and a return on the invested amount during the life of the asset and that levelizes the costs over the life of the asset. AT&T's "green book," which was once (and may still be) used as a handbook by that company's budget analysts, provides an adequate description of this approach. (AT&T 1997, 171) The green book explains that the purpose of what it calls the an annual capital cost charge is to "express the capital recovery costs as 'levelized' equivalent annual costs (AC) for the life of the investment—meaning the annuity equivalent to the present worth of the capital recovery costs over the life of the plant." (AT&T 1977, 171)

As before, for purposes of this exposition, we ignore income taxes (and operating expenses) for simplicity. The annuity payments for a given amount of capital investment that is depreciated over N years, and "carried" at a cost of r, is defined as:

$$K = A(r, N) \; x \; Z_0 \quad \textbf{(2)}$$

where K is the annuity. $A(r,N)$ equals the annuity value of a dollar invested in an asset with a life of N years and a cost of capital of r, and Z_0 equals the

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convention. The other credits and contra-assets typically amount to about 10 percent of TPIS.

original cost[55] of the asset. Equation 2 says that investors are compensated for their original outlay if the income that they receive in each year of the asset's life equals K, which allows for the recovery of and on their investment. The ACCF itself is a function of the weighted average cost of capital (r) and the life of the asset (N):

$$A(r, N) = \frac{r(1+r)^N}{(1+r)^N - 1} \quad (3)$$

To compare to our earlier example, the ACCF approach shows that the annualized cost of a $1,000 asset with a life of 10 years and a risk-adjusted cost of capital of 10 percent is $162.74 per year, rather than the $150 per year computed using the traditional approach.

Lehman and Weisman (2000, Table 4) note that equation 1 typically is used in traditional rate-of-return regulation, while equation 2 is used in TELRIC cost models. That is our experience as well. While there is nothing wrong with applying the ACCF approach to actual, booked data (provided that the application is done properly), the approaches are not mathematically the same, as the earlier examples illustrated. All else the same, the ACCF method will result in capital-related charges that are higher than the traditional method. (Lehman 2000, 70)

We recomputed the ARMIS-based UNE-L and UNE-P costs for each of the states in our sample using the ACCF approach. For each of the state jurisdictions in the sample, we computed the implied life of plant by dividing total telephone plant in service (for the common line, local switching, and switched transport elements) by the associated 2001 depreciation expenses. We found that, on average, UNE-P costs using the ACCF approach of $37.91 were higher than when using the traditional approach ($30.04). (See Figure 6.)

Part of the reason for this difference is that, all else the same, the ACCF approach produces higher capital-related costs than does the traditional approach because the ACCF accounts for net present value, and the traditional approach does not, as just discussed. However, this mathematical difference does not explain the entire gap in this case. Most of the difference relates to the fact that "all is not the same." For the ILECs that we examined their asset accounts do not appear to be in a "steady state." The ratio of Average Net Investment to Telephone Plant in Service is less than one-half, and more on the order of one-third. That is, over the industry, it appears that assets are not being replaced as quickly as they are being depreciated. There are a number of reasons that plant may be replaced more slowly than it is depreciated on the books.

First, ANI is computed as TPIS less accumulated depreciation and amortization and less any regulatory adjustments. Such adjustments may reduce ANI but not affect original cost (TPIS). If such adjustments were large, the ratio of ANI to TPIS could be less than the expected one-half.

Second, the accounting rate of depreciation could exceed the rate of economic depreciation. Assets could be entirely depreciated on the books but

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[55] Original cost here is measured by Total Plant in Service (ARMIS line number 1690).

Figure 6: Unbundled Network Element Prices and Costs
ACCF Method v. Traditional Method
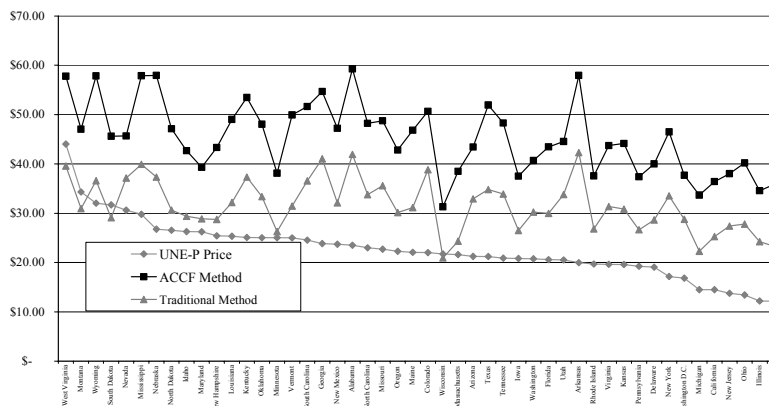
still used in the production process. Such assets would represent zero net investment, but would be carried at original cost. The ratio of ANI to TPIS for these fully depreciated assets would be zero. Depending on the amount of fully depreciated assets that are on the books, the overall ratio of ANI to TPIS could be substantially less than one half.

Third, carriers may anticipate that a change in technology is imminent and may elect to keep existing technology, rather than replace it on the usual schedule with legacy technology, as an economical bridge to the new technology. This would be also consistent with the observed low level in the industry of net plant to gross plant.

Fourth, carriers may also be adjusting their plant usage in light of their incentives to function efficiently under price cap forms of regulation. As we discussed earlier, across the country, states have relinquished "cost-plus" rate of return regulation and migrated to incentive-based forms of regulation. As carriers are migrated away from "cost-plus" regulation, any incentive to over-invest is eliminated and, if such overinvestment occurred, one might see investment decline on a per line basis. This could be reflected for some period of time as a low amount of Average Net Investment relative to the amount of Total Plant in Service.

Finally, the traditional approach is applied to a particular year's accounting data (see equation 1) and so is sensitive to the ANI/TPIS ratio in that particular year. The ACCF methodology operates differently. The ACCF operates on original cost and spreads that cost, in annuity terms, over the life of the asset. Hence, the point in time at which the calculation is performed—and any derivatives from the steady state at that time—do not affect the ACCF calculation if properly performed. The ACCF is, therefore, likely to be more stable over time.

All of these factors (and others) may contribute to the observed situation where ANI is substantially less than one-half of TPIS. We did not investigate the causes for this situation, but note that the fact that it exists and that this situation is responsible, in part, for the fact that capital costs measured using the traditional approach are substantially lower than capital costs measured using the ACCF approach. Regardless of whether the traditional or ACCF approach is used, the UNE-L and UNE-P prices are less than actual cost for the majority of the 48 states that we investigated.

3.5.3   An Alternative Approach to Retail Cost Elimination

The 43-01 ARMIS data include all of the expenses associated with the common line, local switching, and switched transport. In the case of the common line, this includes certain expenditures that wholly or partly relate to the ILEC's retail function and so should not be included in an analysis of wholesale costs. As explained, we eliminated these expenses by adjusting downward our estimated cost of the loop by the resale discount in each state. We applied the resale discount to all of the costs associated with the loop, including the cost of equity. We referred to this as the "tops down" approach.

Alternatively one could remove retail-related expenses by wholly or partly removing those accounts from the cost analysis that relate to retail activities. We performed this approach and found that our results did not change substantially (and we do not report them). We will discuss others' applications of this approach shortly.

3.5.4   Sensitivity of Results to "Original Cost" of Investment

As we discussed, TELRIC-based costs differ from book costs as a result of (1) the use of forward-looking prices; and (2) consideration of technologies that might be used by a hypothetically efficient entrant, but which may not be used by the incumbent. We can apply our cost data to compute the costs associated with replicating the existing network at today's prices, and use this to infer the role of efficiencies implicit in UNE prices.[56] For example, the book costs associated with a particular UNE might be $10 per month, based on the original costs of the assets used to provide the UNE. The "replication cost" associated with that UNE may be $8, because the underlying assets are less expensive today than they were when the actual, existing assets were acquired and installed. If the UNE price is $7, we can infer that engineering differences between the assumed hypothetical and the existing networks account for the additional 12.5 percent reduction in cost.

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[56]   Our anlaysis follows a procedure used by AT&T's witnesses in a UNE pricing proceeding for SBC California. (Brand 2002) In that proceeding, AT&T's witnesses adjusted book costs to "current" (or what we call "replication") costs to analyze efficiencies associated with various expenditures. Although we do not concur with the use to which their adjusted cost analysis was put, we use the same general approach to estimate replication costs.

We performed such an analysis by adjusting the value of each ILEC's existing assets from the original cost, as carried on the books, to current cost. We used book-to-current cost adjustment factors developed by the FCC for its use in the Cost Proxy Model.[57] The results are shown in Table 6. The table shows that, on average, the "replication costs" of the average ILEC network is on the order of $38.54 per UNE-P and $27.05 per UNE-L. Thus, while some costs have increased and some have decreased, on balance, "replication" of the existing ILEC network at contemporary input prices would be approximately 20 percent more costly than are book costs.

This implies that "efficiencies" must account for the difference between the replication cost and forward-looking costs, as represented by UNE prices. Table 6 shows the magnitude required of such efficiencies in the industry. With replication costs on the order of $38.54 per line and an average UNE-P price of $19.30 per line, the hypothetically efficient entrant would have to use approximately *one-half* the resources (at contemporary prices) used by today's ILECs. In other words, the UNE prices imply that a hypothetically efficient firm could serve the all of the (average) ILEC's customers while employing about half the people, and using half the investment and incurring half the expenses, as does the real-world ILEC.

In our opinion, such resource savings are implausible. Moreover, if it were legitimately possible to provide telecommunications services to the existing base of telecommunications customers using half of the resources that currently are being used, there would be easily identifiable and substantial evidence of ILEC inefficiency, such as featherbedding or goldplating. Those whose cost models (implicitly or explicitly) make such efficiency claims are obligated to identify the source of these large resource savings. Failing such a demonstration, such models are properly labeled as being speculative rather than genuinely forward-looking.

Table 6: Analysis of "Replication" Costs and Implied Efficiencies		UNE-P	UNE-L
1	Price	$ 19.30	$ 12.86
2	Actual (Booked) Cost	$ 30.04	$ 19.04
3	Replication Cost	$ 38.54	$ 27.05
4	Difference Between Replication Cost and Price	$ 19.24	$ 14.19
5	UNE Price as a Percent of Repl. Cost	50 %	48 %

Source:
Authors' computations based on book-to-current adjustment to capital asset values from the FCC's
Inputs Order.

Table 6 illustrates that, based on the FCC's analysis of the difference between booked asset values, and the current cost of those same assets, the prices of UNEs imply a substantial amount of "efficiencies" that would be enjoyed by the

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[57] The FCC uses a booked-cost-to-current-cost adjustment factor to to estimate forward-looking plant-specific operations expenses based on present day replacement cost. (Tenth Report and Order 1999, ¶ 342)

hypothetical firm, but not the actual incumbent. We are unaware of efficiencies of this magnitude that a real-world firm might conceivably generate and find nothing to substantiate the use of such efficiencies in the states' UNE Orders and testimony with which we are familiar.

4. A REVIEW AND CRITIQUE OF WHITE PAPERS

While simple in principle, the practical issues associated with cost estimation of the sort described in this paper can be complex. Different analysts may use different, though reasonable, assumptions and produce somewhat different results. Our sensitivity analysis demonstrates that our conclusions are robust to a wide range of assumptions. We are aware of several studies by investment analysts that confirm our analysis that UNE prices do not cover ILEC costs.[58] We are also aware of a number of white papers and advocacy pieces, however, that report results substantially at odds with these, and our own, conclusions. These papers purport to demonstrate that UNE prices are reasonably consistent with ILEC costs and that ILECs may even be fully compensated for their resource costs. We have reviewed a number of these papers, which we discuss in this section. We reviewed Braunstein (2003), Beard and Klein (2003), CompTel (2003), and Beard, Ford, and Klein (2003).

All of these papers commit one of two types of methodological error. The first type occurs when certain categories of cost are ignored. Typically, the papers with this flaw ignore some or all of the capital-related costs, which is a serious omission in a capital-intensive industry. These papers consider only operating costs, and compute earnings before interest, income taxes, and depreciation and amortization ("EBITDA") or earnings before interest and income taxes ("EBIT"). Such financial measures may be useful indicators of the insufficiency of UNE prices, but they cannot indicate the sufficiency of UNE prices. After all, if EBIT (or EBITDA) is negative, one can immediately conclude that prices are not compensatory. But if EBITDA (or EBIT) is positive, one cannot conclude that prices fully compensate ILEC investors for the use of capital.

The second type of methodological error occurs in those papers that attempt to consider all costs, including all capital costs, but do so erroneously. We will explain how these papers misapply the annuity method of computing capital costs to in a way that results in underestimating these costs.

We also find that generally speaking, the white papers have a host of additional errors, such as using inappropriate revenue levels, and we will discuss these issues, but the two methodological errors just mentioned are the ones that substantially drive the erroneous results.

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[58] These are the various Kovacs studies, previously noted, and studies by Merrill Lynch (2002) and UBS Warburg (2002). The Merrill Lynch study computed a cash flow measure as EBITDA less capital expenditures and concluded that UNE prices were less than cash cost in all states except New Hampshire and West Virginia. The UBS Warburg study concludes that EBITDA is negative in 18 states.

4.1   White Papers with Incomplete Analyses

One can sometimes properly conclude, on the basis of partial cost information, that a particular price is not compensatory. However, one can never draw any sensible conclusion about the sufficiency of a particular price to cover costs unless one appropriately accounts for all of the relevant costs. Nevertheless, some analyses attempt to do just that. Examples include *Braunstein* and *Beard and Klein*. *Braunstein* neglects depreciation, interest expense, income taxes, and cost of equity capital, while *Beard and Klein* neglects interest expense, income taxes, and the cost of equity capital.

4.1.1   Braunstein's *The Role of UNE-P in Vertically Integrated Telephone Networks: Ensuring Healthy and Competitive Local, Long-Distance and DSL Markets*

In the above-named paper, the author discusses his views of the telecommunications industry and presents an analysis of UNE-P prices for a single carrier in one state, SBC California. His computations are reproduced in the table below.

	Table 7: Analysis of SBC California UNE Operating Expenses (Per *Braunstein*)		
		Notes	Per Line Per Month
1	Retail Revenues	*UBS*, p. 14.*	$29.81
2	Retail EBITDA Margin	*UBS*, p. 22.*	40 to 50%
3	Retail EBITDA	L1 x L2	$14.91 - $11.92
4	Retail Operating Expenses	L1 – L3	$14.90 - $17.89
5	Retail-Only Costs	L1 x 17%**	$5.07
6	Operating Exp Associated with UNEs	L4 – L5	$9.83 - $12.82

Notes:
*John Hodulik, "How Much Pain from UNE-P? Analysis of UNE-P Economics for the Bells," UBS Warburg Global Equity Research, August 20, 2002. Pages are not cited in *Braunstein*. Our page estimates.
Cited as CPUC D. 97-040090 in *Braunstein*.

The author starts with retail revenues per line for SBC California (as estimated by one of the investment analyst houses) and computes (retail) EBITDA by multiplying revenues by an EBITDA margin (see lines 1 through 3). Retail revenues less retail EBITDA produces retail operating expenses (line 1 less line 3). He removes retail-related expenses by subtracting 17 percent of retail revenues (i.e. line 5) from his retail operating expenses (in line 4) to arrive at his estimate of operating expenses associated with wholesale activities (UNEs). Thus, he estimates the cash operating expenses (expenses excluding depreciation and amortization, interest, and income taxes, as well as costs such as the opportunity cost of equity) that he believes SBC California incurs in providing the UNE-P to be on the order of $9.83 to $12.82 per line per month.

Dr. Braunstein's estimates of operating expenses associated with UNEs are in line with our own estimates.[59] Where Dr. Braunstein errs is in his characterization of these (pre-tax, pre-interest, pre-depreciation, and pre-cost of equity) operating expenses and the inference about profitability that he draws from them.

Dr. Braunstein estimates that SBC California receives $13.97 per month per line for UNE-P. He then concludes that SBC has on the order of $1.15 to $4.14 per line per month "available for profit."[60] (Braunstein 2003, 7) The argument is that the current UNE-P prices "leave room for a profit in this wholesale business of between 9% and 42%." (Braunstein 2003, 7) Moreover, the claim is that "I realize that this is a fairly large range. The estimates used in these calculations come from two different sources and may not be completely comparable. Nevertheless, I think it is clear that one can conclude that *SBC is making a reasonable profit on its wholesale service*." (Braunstein 2003, 13)

Of course, no such conclusion is justified by this limited analysis. The 9 and 42 percent "profit" ratios computed in Braunstein (2003) actually are wholesale EBITDA ratios (that is, wholesale EBITDA divided by the UNE-P price). An EBITDA-to-Revenue ratio is not a profit ratio; it is an operating margin. This margin provides an indication of how much money is available to support capital-related costs, but absent additional information about the magnitude of capital-related costs, one cannot make any sensible conclusion as to the reasonableness of profit on wholesale service.[61]

4.1.2   Beard and Klein's *Bell Companies as Profitable Wholesale Firms*

The title of this paper implies that these economists seek to evaluate the profitability of the Bell companies in providing wholesale services; specifically, in this case UNE-P. However, the authors admit that they do not do so, insofar as they compute EBITDA and EBIT margins and therefore they do not fully account for all capital-related costs.[62] Rather, the authors explain the purpose of their paper "is to evaluate claims by the BOCs and several financial analysts that

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[59]   We estimate these expenses for SBC California to be approximately $11.40.

[60]   That is, $13.97 in revenue less $9.83 in operating expenses equals $4.14, and $13.97 less $12.82 equals $1.15.

[61]   In another example of the same error, in an *ex parte* letter to FCC Chairman Michael K. Powell, Z-Tel (a CLEC) conducts an EBITDA margin analysis and concludes that UNE-P prices "provide the Bells a 'reasonable profit,' as provided for by section 252(d) of the Act." (Curtis 2003, 2) As mentioned, no such conclusion sensibly can be drawn from a partial financial measure such as EBITDA.

[62]   EBITDA margins account for no capital-related costs, while EBIT margins account for the "return of capital," through depreciation expense, but omit the "return on capital" that is indicated by interest expense, income taxes, and the cost of equity capital.

wholesale prices for the combination of unbundled elements called UNE-P are not adequate to cover *operational expenses*." (Beard and Klein 2003, 2)[63] Performed properly, this would be a fair, though uninteresting, analysis. It is fair in the sense that if the Bells and financial analysts have stated that UNE-P prices do not cover operational expenses, one might want to see if this were the case. It is uninteresting in the sense that even if one finds that UNE-P prices cover operational expenses, this supports no inference about whether UNE-P prices provide the opportunity to the ILECs to recoup all of their costs of providing UNE-P, including their cost of capital. Indeed, in a carefully-worded sentence, the authors conclude, "Our results indicated that, on average UNE-P prices of about $20 are fully remunerative to the BOC in the sense of providing a positive operating margin." (Beard and Klein 2003, 3) While we agree that 2001 EBITDA and EBIT margins for UNE-P in most states are positive, this is a feeble claim. The authors merely conclude that UNE-P prices fully recover part of the BOC's costs. To be kind, this is an unhelpful observation for policy purposes. By failing to consider all capital-related costs, Beard and Klein cannot make any claim to ascertaining whether UNE prices compensate ILECs for the costs that they actually incur to provide the UNEs. The analysis does not address the title of their paper, regarding the profitability of Bell companies as wholesale firms.

Beard and Klein uses a bottoms-up methodology with data from the ARMIS 43-03 report (which reflects the regulated/non-regulated split of expenses) to estimate the wholesale operating expenses (excluding capital-related costs such as interest expenses, income taxes, depreciation and amortization, and any return on equity capital) of the BOCs on a consolidated basis. (Beard and Klein 2003, 20) The study identifies specific ARMIS expense accounts that they wholly or partly excluded from a wholesale computation to account for retailing costs. (Beard and Klein 2003, 20-21) The study concludes that operating expenses associated with the provisioning of UNE-P are on the order of $10 per line per month for an average RBOC, and range from $9 to $11 based on several scenarios. (Beard and Klein 2003, 21-22)[64]

As we mentioned, the study's conclusion—that ILEC revenues from UNE-P cover ILEC operating expenses (i.e., positive EBITDA)—is uninformative as a policy matter because it fails to fully consider capital-related costs and so provides no indication of whether UNE prices compensate ILECs for all of their input costs, including the cost of capital. Aside from this problem, there is another significant conceptual flaw with their analysis. Beard and Klein dispute the accuracy of CCM's estimates of average UNE-P prices, on the grounds that the average UNE-P payment by one CLEC, Z-Tel, is higher

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[63] Emphasis added. "Operational expenses" exclude depreciation and amortization expenses.

[64] We are unable to reproduce all of the steps in Beard and Klein (2003), but it appears that in moving from retail to wholesale, the authors reduced Network Costs by 10 percent for an unexplained reason, and then reduced these costs again by 25 percent to account for costs of data-related services.

than CCM's estimate of average UNE-P prices. However, applying Z-Tel's average UNE-P costs to ARMIS costs is an apples-to-oranges comparison.

As we discussed earlier, for purposes of assessing the profitability of UNE prices, one must ensure that the revenue and costs that are used reflect a reasonably similar set of assumptions. For example, if the cost estimates exclude non-UNE items such as Directory Assistance, then revenues should exclude those as well. Similarly, if the cost estimates assume a level of network usage per customer that reflects the ILECs' average, then the revenues estimates should be based on comparable assumptions. It is incorrect to use revenues that are generated under one set of usage assumptions and costs that are generated under another, different set. Similarly, if a CLEC serves customers in geographic areas and density zones that are different in mix from the ILEC's mix, the per-line UNE payments experienced by that CLEC can differ from the mix of lines whose costs are captured in the ILECs' ARMIS accounts as discussed earlier. If that CLEC's customers are more intensive users of telephone service than are the ILEC's customers on average, traffic sensitive revenues will be mismatched against traffic-sensitive costs as reported in ARMIS.

Such a mismatch occurs in Beard and Klein's evaluation of non-recurring charges. Drs. Beard and Klein apply their estimate of CLEC-specific churn rates and other provisioning factors to derive the payments associated with non-recurring charges. However, the study then compares these revenue results with the ILECs' cost data as reported in ARMIS, which, as we discussed, are driven substantially by the ILECs' own experiences regarding churn and other factors. To the extent that the churn rates experienced by CLECs exceed those experienced by ILECs, revenues will be overstated relative to ARMIS-based costs. On the other hand, to the extent that CLEC installations represent a migration rather than a new installation, the non-recurring charges based on the CLEC experience will be understated relative to the non-recurring costs contained in ARMIS, which are driven by new installations.

Drs. Beard and Klein claim that, overall, Z-Tel pays about $24.43 per line per month for the UNE-P lines it buys in 46 states. This is about $2.21 (9.95 percent) higher than the $22.22 that they say CCM estimates.[65] The authors realize that differences can arise, for example, from line mix, but they fail to recognize that this very issue is what would invalidate the Z-Tel data for use in a profit analysis using ARMIS costs and it supports the use of the CCM data. Moreover, while the CCM estimate of BOC-wide national average UNE-P price is within 10 percent of the Z-Tel experience, it varies widely from state-to-state, with the Z-Tel experience in the BellSouth states exceeding the CCM estimate for those states by $7.16 (27.93 percent). The authors make note of the

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[65] The authors do not provide a list of the states, nor do they explain the weightings that were used to aggregate the state-level Kovacs (November 2003) prices to the RBOC level and therefore we were unable to confirm that the representations of the CCM prices were correctly computed.

BellSouth anomaly, but do not explain the reason for it, nor do they provide the Z-Tel data that might explain the discrepancy.[66]

4.2 White Papers with Erroneous Capital-Related Cost Analyses

Whereas the previous papers err by omitting capital-related costs from their analyses, other white papers attempt to include capital-related costs, but do so erroneously. One such paper is a May 2003 CompTel white paper that asserts that claims to the effect that UNEs are priced below cost amounted to "lies." (CompTel 2003, 1) The CompTel paper presents no original analysis. Instead *CompTel* simply relies Beard Ford and Klein (2003) ("*BFK*") regarding UNE costs that is based on ARMIS data. Accordingly, we turn to the latter paper.

BFK attempts to include both the non-capital and capital-related costs that ILECs incur in providing UNEs to CLECs. However, the study computes the capital-related costs erroneously by conflating the two methodologies that we described earlier. We described the "traditional" ratemaking approach in which capital-related costs are computed using equation 1 (or some variation, when income taxes are included). We generally described the ACCF approach as shown in equations 2 and 3. *BFK* conflates the approaches by applying the annual capital charge factor to Average Net Investment, rather than to the original cost of plant (or Telephone Plant in Service).

To see the nature of this error, consider the following example. A firm uses 10 assets of different, staggered vintages. Each asset has an original cost of $1,000 and a useful life of 10 years. In any year, in steady state, the ten-year-old asset is retired and a new, identical $1,000 asset takes its place. Economic depreciation is $100 per year, per asset. In any particular year, the firm has gross plant in service of $10,000, average net investment of $5,000 (in mid-year) and total annual depreciation expenses of $1,000.

Assuming that there is no income tax and that the cost of capital is 10 percent, the annual capital charge factor for each of the assets will be 0.162745.[67] That means that in any year, the firm will have to collect $162.74 per asset (or, in total, $1,627.45 = $162.74 x 10 assets) to provide for a 10 percent return on its investments and also to be able to replace each investment as it wears out.

Under the *BFK* method, an ACCF is derived for, and applied to, average net investment. Under our assumed case, net plant is, on average, $5,000 and the remaining life of the plant is 5 years. Again, assuming a 10

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[66] The authors say that Z-Tel provides UNE-P-based service in 46 states (but do not enumerate these states). (Beard and Klein 2003, 11) The authors do not say whether their price-to-cost analysis is limited only to those states in which Z-Tel provides UNE-P-based service.

[67] $A(r,N) = \dfrac{r(1+r)^N}{(1+r)^N - 1} = \dfrac{0.10 \times (1+.10)^{10}}{(1+.10)^{10} - 1} = 0.162745.$

percent cost of capital, the ACCF in this instance is 0.263797, and it is applied to average net investment of $5,000 to generate $1,318.99 per year (or $131.90 per asset).[68] The $131.90 is $30.84 less, per year, than the amount required to generate sufficient cash to replace each asset at the end of its useful life (return of capital) and to compensate investors for their investment (return on capital). Hence, the application of the formula to Average Net Investment, even though we adjusted the asset life to reflect the remaining life of the Average Net Investment, results in an annualized "cost" figure that is insufficient to compensate investors for their initial investment. At $131.90, investors would not have been willing to invest in a $1,000 asset to begin with. Investors require $162.74 in each year, including each of the remaining 5 years, just to recover the initial investment and the cost of capital. Prices that generate $131.90 (rather than the required $162.74) will not recover the necessary funds over the remaining life of the asset to recover the initial capital outlay.

The severity of the shortfall depends on the assumed life, the cost of capital, and the proportionate difference between gross and net investment. All else the same, the greater the presumed life, the greater the discount rate, and the greater the ratio of gross-to-net investment, the greater will be the shortfall when applying the ACCF approach to Average Net Investment, rather than (gross) Telephone Plant in Service. In no instance where Average Net Investment is less than Telephone Plant in Service and the remaining life exceeds a year will the ACCF approach applied to Average Net Investment provide more revenue than will the ACCF approach applied to Telephone Plant in Service.[69] Hence, the ACCF approach applied to Average Net Investment always will under recover total capital-related costs.

The error can be substantial.   In *BFK*, capital-related costs are understated by approximately $10 to $13 per line per month.[70] When this error is corrected, the qualitative conclusions of *BFK* are completely reversed, and the *BFK* data show that UNE-P prices are not compensatory to the ILECs.

BFK makes other errors in its analysis. The study's estimate of UNE-P revenues is flawed for all of the same reasons described earlier in reference to *Beard and Klein*; namely, *BFK* relies on the revenue experience of a single CLEC, Z-Tel, which has not been shown to conform to the same geographic, usage, churn, or migration parameters as those that drive the costs as reported in ARMIS. (*BFK*, 9-14) Such an approach is not an appropriate way to develop UNE-P "prices" for comparison to ARMIS-based cost data. If one wants to compare costs to Z-Tel's revenue data, one cannot use ARMIS cost data unless those data are adjusted to reflect the usage, services, and other determinants of Z-Tel's revenues.

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[68]   One arrives at the same answer whether applying an overall ACCF to net plant or an individualized ACCF to each asset.

[69]   See Appendix A.

[70]   Our estimate of capital-related costs using the traditional method is about $17.50 for all states on a line-weighted basis, and about $20.41 using the ACCF approach, properly applied. *BFK* estimate capital-related costs of $7.32. (*BFK*, 20).

On the matter of expenses, *BFK* adopts the method of analysis used in the instant paper and that one of the authors of this paper used in testimony before regulatory commissions to identify expenses and investment associated with the common line, local switching, and switched transport.[71] *BFK* then uses the "bottoms up" approach to reviewing various ARMIS accounts (for the year 2001) and wholly or partly removes them if they do not seem to be related to UNEs. We are unable to replicate *BFK's* steps used to remove retail-related costs from total costs to produce wholesale-related costs. *BFK* computes avoided retail costs to be on the order of 38 percent of its total retail costs (including capital costs).[72] It strikes us as unlikely on its face that an ILEC would incur retailing costs that amount to 38 percent of its total costs, including capital-related costs) to provision local exchange service to its customers. We conclude that our own methodology for computing the retail-to-wholesale avoided costs using the state regulatory commission discount rate provides a transparent and supportable way of addressing this issue which might serve as a rebuttable presumption for those who would elect a bottom's up methodology.

5.   CONCLUSIONS AND IMPLICATIONS

State regulatory commissions are required to evaluate UNE prices based on forward-looking costs as defined in the FCC's TELRIC standard. Our analysis shows that these commissions are not properly applying that standard, but instead are indulging in speculation about possible future costs. State utility commissions may be bowing to pressure to encourage virtually any entry that has the trappings of competition.[73] Below-cost UNEs will encourage such entry. However, such entry is not in the long-term interests of consumer. There is no competition on what is shared, and under UNE-P, virtually the entire telephone network becomes a shared resource. Entry borne of below-cost UNEs comes at a social cost that can be measured in terms of foregone investment by both ILECs and CLECs, as investors wait out what is clearly a political and non-market-based situation. CLECs unable or unwilling to obtain funding for infrastructure investment remain dependent on ILEC networks, with no diversity of network supply. One step toward reestablishing investment and employment incentives in the telecommunications industry would be to correct the substantial mispricing of UNEs that exists in the market today.

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[71]   *BFK*, fn. 39, citing Aron (2002).

[72]   The 30 percent difference compares *BFK*'s UNE-P operating expenses to our estimate of retail operating expenses for the common line, local switching, and switched transport. The 50 percent reduction relates *BFK*'s UNE-P operating expenses related costs to *BFK*'s estimate of retail costs. In either case, the implied "avoided costs" are far in excess of those found by state regulatory commissions in their investigations. This points out the lack of transparency in using the bottom's up methodology in these studies and not providing the underlying data for review.

[73]   For example, the chairman of the Public Utility Commission of Ohio said, "A little over a year ago, we forced that TELRIC price down, just to give competitors a foothold. The political pressure was huge." (Schriber 2003)

Appendix A

Demonstration that the ACCF Method Applied to Net Investment always Under Values Capital-Related Costs

Define:

TPIS = total plant in service, or gross asset value

ANI = net investment (i.e., TPIS less accumulated depreciation)

r = weighted average cost of capital

Let N be the life of the assets and assume that assets depreciate linearly without salvage. In year j, the remaining life of an asset is $N - j$. The ACCF formula $A(r, N)$ applied to total (gross) plant is:

$$\frac{r(1+r)^N}{(1+r)^N - 1} \times TPIS$$

The ACCF formula applied to net plant is:

$$\frac{r(1+r)^N}{(1+r)^N - 1} \times \frac{N-j}{N} \times TPIS ,$$

where $\dfrac{N-j}{N} TPIS$ is the percentage of total plant remaining after j periods.

Proposition: Assume   (A1) $r > 0$

                                   (A2) $j \leq N$ and

                                   (A3) N is an integer > 1.

Then,

$$\frac{r(1+r)^N}{(1+r)^N - 1} > \frac{r(1+r)^{N-j}}{(1+r)^{N-j} - 1} \frac{N-j}{N} \qquad \forall \; j < N.$$

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Observe that when $j = N$, the LHS is positive by A1 and A3; and the RHS is zero. Observe also that when $j = 0$, the expression holds with equality. Hence, because the LHS is constant in j, the proposition holds if the RHS is monotone decreasing in j. Therefore it is sufficient to show that:

$$\frac{r(1+r)^{N-j}}{(1+r)^{N-j}-1} \frac{N-j}{N}$$

is monotone decreasing in $j, \ \forall \ j < N$.

For convenience, let $\quad a \equiv 1 + r$

$$\text{and} \quad x \equiv N - j.$$

Then it is sufficient to show that

$$f(x) = \frac{xa^x}{a^x - 1}$$

is monotone increasing in x, or that:

$$\frac{df}{dx} > 0.$$

Differentiating f with respect to x,

$$\frac{df}{dx} = \frac{(a^x - 1)(a^x + xa^x \ln a) - xa^x(a^x \ln a)}{(a^x - 1)^2}$$

$$= \frac{1}{(a^x - 1)^2}\left[a^x(a^x - 1) + a^x(xa^x \ln a) - xa^x \ln a - xa^x(a^x \ln a)\right]$$

$$= \frac{1}{(a^x - 1)^2}\left[a^x(a^x - 1) - xa^x \ln a\right]$$

$$= \frac{a}{(a^x - 1)^2}(a^x - 1 - x \ln a).$$

Since $a^x > 0$,

$$\frac{df}{dx} > 0 \ \text{ if and only if}$$

$$a^x - 1 - x \ln a > 0. \qquad (1)$$

By Taylor series expansion,

$$a^x = e^{x \ln a} = 1 + \frac{x \ln a}{1!} + \frac{(x \ln a)^2}{2!} + \ldots + \frac{(x \ln a)^m}{m!} + \ldots$$

Hence, (1) becomes

$$1 + \frac{x \ln a}{1} + \left[1 + \frac{(x \ln a)^2}{2!} + \ldots \right] - 1 - x \ln a$$

$$= \frac{(x \ln a)^2}{2!} + \frac{(x \ln a)3}{3!} + \ldots$$

Every term of which is positive by A1 and A2.

<div align="right">Q.E.D.</div>

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